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ACCEPTANCE

This dissertation, MAPPING THE ROAD TO INSTRUCTIONAL COACH EFFECTIVENESS: EXPLORING THE RELATIONSHIP BETWEEN INSTRUCTIONAL COACHING EFFICACY, PRACTICES, AND OUTCOMES, by MARSHA CECILE MC CRARY, was prepared under the direction of the candidate's Dissertation Advisory Committee. It is accepted by the committee members in partial fulfillment of the requirements for the degree Doctor of Philosophy in the College of Education, Georgia State University.

The Dissertation Advisory Committee and the student's Department Chair, as representatives of the faculty, certify that this dissertation has met all standards of excellence and scholarship as determined by the faculty. The Dean of the College of Education concurs.

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ABSTRACT

MAPPING THE ROAD TO INSTRUCTIONAL COACH EFFECTIVENESS: EXPLORING THE RELATIONSHIP BETWEEN INSTRUCTIONAL COACHING EFFICACY, PRACTICES, AND OUTCOMES

by

Marsha C. McCrary

Despite the presence and potential impact of instructional coaches, many schools are not experiencing significant improvements in teachers' practices or student achievement. In gaining more insight into forces that impact instructional coach effectiveness, this study (a) explored the relationship between sources of instructional coaching efficacy and dimensions of instructional coaching efficacy [*Mathematics Content & Mathematics-Specific Pedagogy (ME), Student Centered & General Pedagogy (SE), Interpersonal & Communication Coaching (IE), and Personal Coach Characteristics*]; and (b) explored the relationship between dimensions of instructional coaching efficacy and instructional coach outcomes. Participants included teachers (n=144) and their instructional coaches (n=19), from elementary schools located within a large urban school district in the southeastern U.S. Teachers completed an adapted Coach Effectiveness Questionnaire (Yopp, Burroughs, & Sutton, 2010), which assessed their perceptions of coach outcomes. Coaches completed an adapted Coach Efficacy Questionnaire (Yopp, Burroughs, & Sutton, 2010), which assessed their perceptions of source information and dimensions of instructional coaching efficacy. Significant correlations were found between the source Degree Major (Math) and ME (r =.534). Moreover, canonical correlation analysis showed that dimensions of instructional coaching efficacy were significantly associated with instructional coach outcomes, $F(45, 363.21) = 2.326$, $p < .001$. Particularly, regression analyses found IE to be predictive of

instructional coach behavior (β =.395, t = 3.534, p < .01); instructional coach impact (β =.343, t = 2.982, p < .01); and teacher satisfaction (β =.264, t = 2.272, p = .025) with their instructional coach. Mathematics content & mathematics-specific coaching efficacy (ME) was also predictive of teacher satisfaction with their instructional coach (β =.181, t = 2.012, p = .046). These results were generally supportive of the theoretically expected relationships between instructional coaching efficacy and instructional coach outcomes. Lastly, context and individual instructional coach qualities accounted for a substantial amount of variance in instructional coach outcomes. These findings are consistent with previous research that link situational factors and individual differences to coach effectiveness (Horn, 2002).

MAPPING THE ROAD TO INSTRUCTIONAL COACH EFFECTIVENESS: EXPLORING THE RELATIONSHIP BETWEEN INSTRUCTIONAL COACHING EFFICACY, PRACTICES, AND OUTCOMES

by
Marsha C. McCrary

A Dissertation

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in
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in
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in
the College of Education
Georgia State University

Atlanta, GA
2011

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CHAPTER 1

Introduction

"Although most U.S. mathematics teachers report familiarity with reform recommendations, only a few apply the key points in their classrooms" (National Center for Education Statistics, 1996, p. 70). Many researchers refer to this reality as the 'research-to-practice' gap (McKinney & Frazier, 2008). In efforts to close this gap, researchers have been adamant in trying to identify effective strategies that support teachers in transforming their practices in ways that promote the vision of mathematics reform. Most notably, findings from such pursuits have resulted in a renewed appreciation of the idea that it is unreasonable to expect that changes advocated by curriculum reforms will occur devoid of 'job-embedded' professional development (Collopy, 2003), such as coaching.

Most likely fueled by "…educators' recognition that traditional one-shot approaches to professional development are ineffective at improving teaching practices" (Knight, 2009, p. 18); 'coaching' has reemerged within the last decade as a powerful professional development strategy for supporting teachers' efforts to translate research-based teaching strategies into practice. Several studies have confirmed this idea by consistently highlighting the critical role that 'coaching' plays in increasing the likelihood that teachers transfer newly learned skills to the classroom (Bush, 1984; Cornett & Knight, 2008; Greene, 2004; Joyce & Showers, 1982; Truesdale, 2003). Most importantly, these studies have identified the mentor approach to providing teachers with the opportunity to 'practice' what they learn from the professional development, receive feedback from peer observations, and reflect and discuss their practices as a critical

process of effective coaching. Though several distinct approaches to coaching exist, *instructional coaching* is the most appropriate approach for promoting reform-oriented teaching, because it involves the partnering of instructional coaches with teachers in efforts to help them incorporate research-based instructional practices that positively impact student learning (Knight, 2009).

Just as teachers play a critical role in student learning, instructional coaches play a significant role in teacher implementation and sustainment of mathematics reform efforts. However, what has begun to emerge from the research on coaching is the notion that 'coaching outcomes' or effectiveness is primarily driven by 'sources' such as coach knowledge, experience, and expertise (Campbell & Malkus, 2009; Manno & Firestone, 2008; Taylor, 2008). In a three year study of the impact of mathematics coaches on teacher and student performance, Campbell and Malkus (2009) found that mathematics coach' impact was positively related to coach' years of 'experience'. Such sources significantly influence instructional coaching efficacy, which is the extent to which instructional coaches believe that they have the capacity to affect the learning and performance of their teachers.

Sources of instructional coaching efficacy influence perceived instructional coaching efficacy, and as a result, impacts instructional coach behavior. This relationship is best explained by Bandura and Adams' (1977) theory of self-efficacy which postulates that "…perceived self-efficacy affects people's choice of activities and behavioral settings, how much effort they expend, and how long they will persist in the face of obstacles and aversive experiences" (Bandura & Adams, 1977, p. 287-288). These findings accentuate the significant role that coaching characteristics and conditions play

in determining ‘coach effectiveness’. Therefore, in efforts to propel and sustain current mathematics reform initiatives, a deeper engagement and analysis of key individual characteristics that afford mathematics instructional coaches the opportunity to catalyze and sustain school-based efforts to implement reform-based mathematics is warranted.

The Evolution of Coaching in U.S. Schools

Since the emergence of organized common schooling in the early 1800s, government officials have been increasingly concerned with the need to ensure that effective teaching and learning occur within all public schools. In accomplishing this goal, school systems have and continue to employ instructional supervisors who are responsible for ensuring that teachers effectively implement appropriate curriculum and students learn meaningful mathematics content. As curriculum reform places new demands on teachers and students, the title, role, and behavior of supervisors of instruction have and continue to evolve.

Dating back to the 1800s, “committee men fulfilled the function of supervisors by giving directions, checking for compliance with teaching techniques, and evaluating results of instruction by the teachers in their charge” (Oliva & Pawlas, 2004, p. 5). Such supervisors would observe teacher instructional ‘compliance’ and dismiss teachers who deviated from stipulated instruction (Oliva & Pawlas, 2004). For the most part, the role of instructional supervisors during the first half of the nineteenth century was to ensure that “…teachers were following the prescribed curriculum and that students were able to recite their lessons” (Starratt, 2002). As the number of organized school communities increased, the need for new methods of instructional supervision became apparent. As a result, several aspects of instructional supervision changed. Specifically, trained

educators, such as superintendents and principals, assumed the role of instructional supervisor from parents, clergy, citizens' committees and others. With such changes, the purpose of instructional supervision evolved from that of "looking for deficiencies meriting dismissal of teachers to helping teachers overcome difficulties" (Oliva & Pawlas, 2004, pg. 6). Because the method of instruction used by teachers to foster students' learning of arithmetic was not demanding nor a drastic departure from their current understandings of the teaching and learning of mathematics, instructional supervisors were not overwhelmed with the task of transforming teacher practice. Therefore, classroom observations and feedback were sufficient means for evaluating and improving teaching and learning; however, by the onset of the twentieth century, teachers would require additional support in effectively implementing mathematics curriculum.

With the emergence of child-centered and experience based curriculum reforms, the first half of the twentieth century marked a period in which teachers required more than mundane evaluative feedback regarding classroom observations. Because Progressive Education involved student-centered discovery learning, most teachers required additional professional support in effectively implementing curriculum. As a result, "…school supervisors often found themselves caught between the demand to evaluate teachers scientifically and the simultaneous need to transform teaching from a mechanistic repetition of teaching protocols to a diverse repertory of instructional responses to students' natural curiosity and diverse levels of readiness" (Starratt, 2002). Although a solution to the dilemma faced by many instructional supervisors did not materialize during the first half of the twentieth century, this period marked the beginning

of a newly found awareness that a gap existed in the research on teacher professional development, particularly between research and classroom instruction.

The need for effective professional development strategies heightened during the 1950s, 1960s, and 1970s as reformers continued to highlight teachers' inability to transform their teaching as one of many vital factors in the demise of mathematics curriculum reforms (Roberts, 2001). In 1969, the first signs of a coaching 'model' emerged. Frustrated with their inability to successfully transform new teachers' practices, Harvard university supervisors, Goldhammer and Cogan, borrowed the term 'clinical supervision' from the medical profession, where it was and still is used to describe a 'process' for perfecting the specialized knowledge and skills of practitioners (Krajewski & Anderson, 1980). Unlike previous attempts to improve curriculum implementation through supervisory classroom inspections, clinical supervision involved a combination of classroom observations, planning, and reflection.

According to Goldhammer (as cited in Krajewski & Anderson, 1980), who initially proposed a 5-stage process that included: pre-observation conference, classroom observation, data analysis and strategy, conference, and post conference analysis, clinical supervision involved face-to-face relationships between a supervisor and teacher. Furthermore, it involved "…the deliberate and direct 'intervention by a skillful' observer into the professional performances or episodes of teaching behavior in which the person being helped engages" (Krajewski & Anderson, p. 422). Although this marked the initial beginnings of 'coaching', teachers were reluctant to accept clinical supervision as support and viewed it more as evaluation because their supervisors were their principals or other evaluative staff. Additionally, teachers did not view clinical supervision as instructional

support because supervisors were rarely able to complete the 5-stage clinical supervision process given the number of teachers in their building. As a result, Clinical Supervision failed to fully materialize because it was too time consuming and labor intensive (Krajewski & Anderson, 1980) for school administrators.

By the early 1970s, educators realized that many of the curriculum reforms of previous eras "…even when well funded and approved by the public, seldom led to changes" (Joyce & Showers, 1996, p. 13). According to Joyce and Showers (1996), a lack of knowledge on how teachers best learn new teaching strategies and how schools successfully disseminate innovations contributed to previous reform failures. By the 1980s "…enough research on the topic of teacher professional development had been conducted to permit the formation of a theoretical hypothesis about how teachers learn about new practices through presentations of new knowledge and skills" (Denton & Hasbrouck, 2009, p. 152). Prior to this period, research in the areas of training, curriculum improvement, or the implementation of innovations had gradually grown from a half-dozen experimental studies in 1957 to an increasingly broader amount in 1977 (Showers, Joyce, & Bennett, 1987). Such growth finally resulted in an adequate amount of research on teacher professional development to formulate the theory 'coaching', which was guided by the hypothesis that coaching following initial training would result in greater transfer of new knowledge than training alone (Joyce & Showers, 1981). Although the early to mid 80s marked a pivotal point in research on professional development, the 1980s served as a period of investigation of the theory of coaching.

In the wake of the 1983 report *A Nation at Risk,* which called attention to the quality of teachers and teacher training programs, emerging findings from research on

coaching were very encouraging. During this period, research on the effects of professional development that involved presentations of new learning followed by observation and feedback confirmed that coaching was indeed a very promising solution for bridging the gap between newly learned knowledge and teachers' transfer of quality instruction to the classroom. Furthermore, the birth of 'coaching' brought about an increased awareness of the need for peer experts who were capable of not only observing classroom instruction and providing feedback but who could also 'model' new strategies within teachers' classrooms. Although a potentially powerful vehicle for teacher change, coaches during this period "typically provided supplemental instruction directly to students who struggled rather than providing coaching support to the students' classroom teachers" (Dole, 2004, as cited in Denton & Hasbrouck, 2009, p. 153).

Despite misuse of instructional coaches during the 80s and 90s, school systems began to reevaluate how they were using instructional coaches during the late 1990s and early 2000s. With alarming findings from the Third International Mathematics and Science Study (TIMSS), which highlighted teachers' inadequate implementation of national curriculum standards as the rationale for U.S. students' mediocre academic performance, several federal initiatives emerged in efforts to address and improve teachers' effective implementation of national standards. Particularly, the *No Child Left Behind Act of 2001* (NCLB) required that "professional development programs incorporate activities, like coaching, that are provided consistently over time" (Kowal & Stein, 2007). Such federal mandates have and continue to result in an overwhelming emergence of different forms of coaching, which currently include technical coaching,

collegial coaching, challenge coaching, team coaching, cognitive coaching, peer coaching, and instructional coaching.

"[O]ne constant finding in the research literature is that notable improvements in education almost never take place in the absence of professional development" (Guskey, 2000, p. 4). Today, many school districts are beginning to acknowledge this powerful declaration as well as the implications of research that highlight effective professional development strategies that promote teachers' transfer of new learning to classroom practice. As a result, many low-performing school districts across the nation are investing a great deal of time and financial resources in instructional coaches, (Kowal & Steiner, 2007) in high hopes of reform implementation and sustainment.

Problem Statement

Despite the presence and potential impact of mathematics instructional coaches in many of the nations' urban schools, many of these schools are not experiencing significant improvements in teachers' practices or student achievement. Whilst some researchers attribute this lack of improvement in teacher instruction and/or student learning to instructional coach quality (Knight, 2004a), preparation (Coggins, Stoddard, & Cutler, 2003; Lowenhaupt & McKinney, 2007; Neufeld & Roper, 2002; Tung, Ouimette, & Feldman, 2004), knowledge (Kennedy, 1991b), and/or adoption of practices that have an insignificant impact (Saphier & West, 2010), others are reluctant in drawing such conclusions that are based on what they consider as an immature/under-researched strategy (Taylor, 2008). Therefore, the problem of defining factors that influence coach effectiveness remains a challenge.

Purpose

The purpose of this study is: a) to explore the relationship between sources of instructional coaching efficacy and dimensions of instructional coaching efficacy; and b) to explore the relationship between dimensions of instructional coaching efficacy and instructional coach outcomes, as it relates to mathematics education.

Definition of Terms

Reform Teaching: Reform teaching, in the context of the present study is "…empirically defined to include activities related to the implementation of high-demand tasks that foster the development of mathematics concepts and understanding…It is aligned with the vision promoted by NCTM's Professional Teaching Standards in which reform teaching is a style of instruction that encourages students to communicate mathematical ideas; nurtures intellectual risk-taking by promoting conjecturing, problem solving, and investigation of mathematical ideas; and provides students with opportunities to deepen their understanding of mathematics" (Franco, Sztajn, & Ortigão, 2007).

Instructional Coach: "An instructional coach partners with teachers to help them incorporate research-based instructional practices into their teaching… [which] help students learn more effectively" (Knight, 2009, p. 30).

Effective Instructional Coach: Effective instructional coaches "…are skilled communicators, or relationship builders, with a repertoire of excellent communication skills that enable them to empathize, listen, and build trusting relationships" (Knight, p. 31). Effective instructional coaches are experts in content, pedagogy, curriculum, and interpersonal communication (Borman & Feger, 2006; Feger, Woleck, &Hickman, 2004;

Kinkead, 2007; Knight, 2004b; Kowal & Stein, 2007; Saphier & West, 2010; West & Staub, 2003).

Instructional Coach Behavior: "Instructional coaches (ICs) use a variety of professional development procedures to encourage widespread, high-quality implementation of effective teaching practices, including holding one-to-one or small group meetings during which ICs can identify how to address their most pressing concerns; guiding teachers through instructional manuals, checklists, and other materials; collaboratively planning with teachers to identify when and how to implement effective instruction; preparing materials for teachers prior to instruction; modeling instructional practices in teachers' classrooms; observing teachers whey they use interventions; and providing feedback to teachers" (Knight, 2004, as cited in Knight, 2005, pg. 17).

Instructional Coach Impact: The extent to which an Instructional Coach 'affects' teaching and learning.

Instructional Coaching Efficacy: The extent to which instructional coaches believe they have the capacity to affect the learning and performance of their teachers.

Sources of Instructional Coaching Efficacy: Factors that influence an Instructional Coach's confidence in their ability to produce desired coaching results. These factors include: Perceived Teacher Ability, Perceived School/Leadership Support, Teaching (Yrs) Experience, Coaching (Yrs) Experience, Education: Degree Level, and Education: Degree Major. Specifically, factors that influence a mathematics instructional coach's confidence in their ability to produce desired coaching results include: Perceived Mathematics Teacher Ability, Perceived School/Leadership Support, Mathematics

Teaching (Yrs) Experience, Mathematics Coaching (Yrs) Experience, Education: Degree Level, and Education: Degree Major (Math).

Dimensions of Instructional Coaching Efficacy: Critical areas that Instructional Coaches must possess a particular level of 'confidence' in, in order to produce desired instructional coaching outcomes. These areas include: subject-specific content and pedagogy, student-centered and general pedagogy, interpersonal and communication and personal coach characteristics. In the context of this study, personal coach characteristics are defined as personality traits, such as work ethic, resilience, determination, analysis skills, and other individual characteristics, that may contribute to an instructional coach's efficacy.

Instructional Coaching Outcomes: Instructional coaching outcomes encompass instructional coach behaviors, instructional coach impact, and teacher satisfaction with their instructional coach.

Instructional Coach Effectiveness: The extent to which instructional coaches implement their knowledge and skills to positively affect the learning and performance of their teachers, and the students within their schools.

Research Questions

1. To what extent are the sources of instructional coaching efficacy associated with dimensions of instructional coaching efficacy?
2. To what extent are dimensions of instructional coach efficacy associated with instructional coach outcomes?

In addressing the paucity of research on coaching, and the ever-present issue of teacher' impact on mathematics reform implementation, the purpose of this study is to further

explore conditions that may potentially influence instructional coach outcomes and effectiveness. Although this study is exploratory in nature, the Instructional Coaching Efficacy theoretical framework, which is an adaption of the Coaching Efficacy framework proposed by Feltz, Chase, Moritz, and Sullivan (1999), guides the selection of variables and relationships to explore and test.

Rationale

Although extant research supports the idea that coaches can be very effective in helping teachers to implement newly learned strategies in their classrooms (Bruce &Ross, 2008; Greene, 2004; Hubbard, Mehan, & Stein, 2006; Kohler, Ezell, & Paluselli, 1999; Licklider, 1995; Roehrig, Kruse, & Kern, 2007; Stein & D'Amico, 2002; Taylor, 2008), studies on driving forces that relate to coach effectiveness are less developed. Despite developing research that has identified key areas of expertise (content-specific knowledge, pedagogy, curriculum, and interpersonal communication) that effective coaches must possess, only a small set of studies have explored the 'relationships' between these characteristics and coach effectiveness (Borman & Feger, 2006). Therefore, the rationale for this study stems from its potential to contribute to the current, yet limited, body of knowledge on instructional coaching (Knight, 2008; Taylor, 2008) and coach effectiveness.

Beyond mere analysis of variables that could influence instructional coaching efficacy, the rationale for this study also lies in the need for a more defined understanding of why many schools that employ full-time on-site instructional coaches are not significantly impacting teaching practice and student achievement. As a mathematics consultant in an urban school system that employs full-time instructional coaches for

each elementary (K-5) and middle (6-8) school, I am occasionally called upon to explain why the researched based practice of coaching is not producing desired results in our school district. Additionally, I am frequently expected to provide direction for instructional coach professional development. Because research on coaching is still emerging, and in some instances inconsistent, I am rarely able to provide well supported answers that are grounded in research and theory. In order to make informed decisions as it relates to instructional coaches, the development of coaching frameworks that can assist in explaining the dynamics of instructional coaching is critical (Borman & Feger, 2006).

Significance of the Study

With a descriptive model of relationship patterns between dimensions of instructional coaching efficacy and instructional coach outcomes, school districts, policy makers, and other evaluators, will be more informed about instructional coach efficacies that are significantly related to particular instructional coach outcomes. With this knowledge, school and district leaders will be more capable of recruiting and screening for effective instructional coaches. Findings from this study also stand to inform future efforts to support the professional growth of mathematics instructional coaches by identifying the specific dimensions of instructional coaching that relate to particular instructional coach behaviors, instructional coach impact, and teacher satisfaction with their instructional coach. With knowledge of particular dimensions that are significantly associated with instructional coach outcomes, researchers will be more informed in answering a major question that remains important to the progression of research on coaching, *"What support systems should be in place for coaching to flourish?"* (Knight,

2008, p. 210) Therefore, this study stands to not only increase the knowledge base of instructional coaching, but also to provide a descriptive model that can be used by school districts, policy makers, teacher educators and other evaluators in future research on mathematics instructional coaching.

In addition to practical significance, this study also has theoretical significance. According to Borman and Feger (2006), "[a]t this point in time, researchers need to specify explicit coaching frameworks as they analyze the components of coaching and their possible impacts" (p. 13). This study introduces the adaptive framework, instructional coaching efficacy, that can be used by future researchers to explore and test hypothesis related to the relationships between dimensions of instructional coaching efficacy and instructional coach outcomes. Very few efficacy studies have been conducted on instructional coaching (Borman & Feger). Therefore, this study also stands to add to the growing yet 'immature' (Taylor, 2008) research on the effectiveness of instructional coaching.

Theoretical Framework

Coaching Efficacy

Within this study, an adapted version of Feltz, Chase, Moritz, and Sullivan's (1999) Coaching Efficacy framework will be used to analyze the relationships that exist between sources of instructional coaching efficacy, dimensions of instructional coaching efficacy, and instructional coaching outcomes. Grounded in the idea that human behavior is influenced by one's belief in their ability to affect their environment, Feltz and colleagues' theory of *Coaching Efficacy* is described as "…the extent to which coaches believe they have the capacity to affect the learning and performance of their athletes"

(Feltz et al., 1999, p. 765). Like Bandura's (1977) theory of Self-efficacy and Denham and Michaels' (1981) theory of teaching-efficacy, coaching efficacy is framed by the idea that various sources influence a sport coach's belief about their potential to affect the success of their players (coaching efficacy). Sources of coaching efficacy include: extent of coaching experience/preparation, prior success (won-lost record), perceived skill of athletes, and school/community support. These sources influence four key dimensions of effective coaching: game strategy, motivation, teaching technique, and character. In turn, Feltz' et al. (1999) proposes that these coaching efficacy dimensions influence coach outcomes, such as coaching behavior, player/team satisfaction, player/team performance, and player/team efficacy. A conceptual model of coaching efficacy is diagramed in Figure 1.

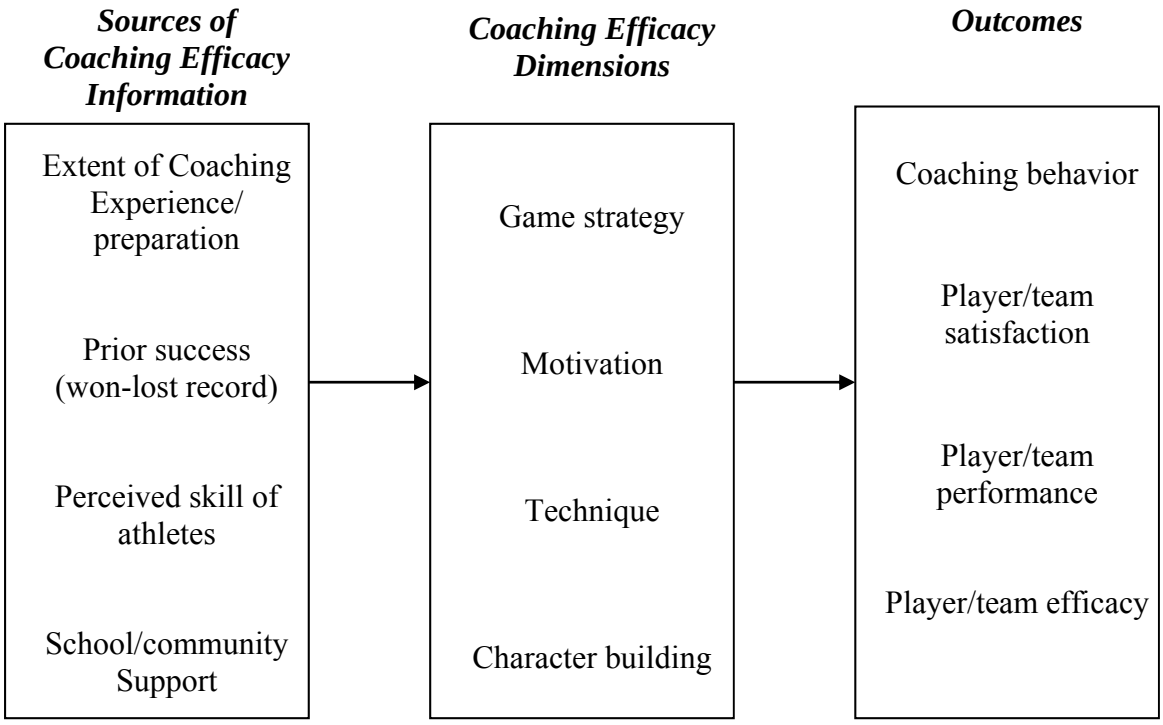

Figure 1. Conceptual model of coaching efficacy.

Instructional Coaching Efficacy

Parallel to the definition of coaching efficacy, *Instructional Coaching Efficacy* is the extent to which instructional coaches believe they have the capacity to affect the learning and instructional practices of their teachers. Building upon this notion, *Instructional Coaching Efficacy* is structured by the idea that various 'sources' drive how confident or efficacious an instructional coach is in their ability to positively impact the instructional practices of their teachers. Specifically, sources of instructional coaching efficacy such as education: degree level, education: degree major, teaching and coaching experience, perception of teacher ability, and school/leadership support, are key contributors to an instructional coach's beliefs about how successful they will be in producing desired results as it relates to instruction.

Just as self-efficacy for classroom teaching is an important aspect of teaching effectiveness (Denham & Michael, 1981; Guskey & Passaro, 1994; Hoy & Woolfolk, 1993), coaching efficacy is a powerful variable in predicting coach effectiveness (Feltz et al., 1999). Most importantly, it is an instructional coach's efficacy, in specific dimensions of instructional coaching, which predict their behavior and ultimately their effectiveness. For instance, being highly efficacious only in the ability to manage student behavior may not result in instructional coach behaviors that are directly tied to improving teachers' mathematics content and pedagogy. On the contrary, an instructional coach who is highly efficacious in mathematics content and pedagogy maybe more likely to model effective teaching strategies which support teachers in teaching mathematics for student understanding than will an instructional coach who is not very confident in their content or ability to model instructional strategies that promote mathematical understandings.

Therefore, in order to display behaviors that produce successful results, instructional coaches cannot be efficacious in just any one area; they must possess confidence in their abilities to employ multiple 'effective' strategies that produce desired outcomes.

Just as dimensions of coaching efficacy emerged as a result of review of most pertinent literature on effective sports coaches, a in-depth analysis of extant research on effective professional developers has identified 3 dimensions as critical components of effective instructional coaching: subject-specific content and pedagogy, student-centered & general pedagogy, and interpersonal communication skills (Borman & Feger, 2006; Killion & Harrison, 2005; Kinkead, 2007; Knight, 2004b; Kowal & Stein, 2007). Subject-specific content and pedagogy coaching efficacy is defined as the confidence instructional coaches have in their ability to coach and support teachers in subject-specific content and subject-specific pedagogy. Student-centered and general pedagogy coaching efficacy is defined as the confidence instructional coaches have in their ability to coach and support teachers in creating and facilitating student-centered learning environments, as well as supporting teachers' employment and implementation of general pedagogical strategies. Interpersonal communication skills coaching efficacy is defined as the confidence instructional coaches have in their ability to foster professional relationships through effective dialogue (communication and feedback), that promote teachers' reflection on instructional practice.

Just as Feltz' et al. (1999) Coaching Efficacy framework proposed a unidirectional relationship between dimensions and outcomes, the dimensions of Instructional Coaching Efficacy too appear to be predictive of coaching outcomes; in that, instructional coaches who possess efficacy in such areas have been identified as

effective instructional coaches who positively impact instruction. For instance, a coach who is highly efficacious in mathematics-specific content and pedagogy will potentially be more effective in facilitating a rich mathematics discussion around the concept of fractional 'understandings' than a coach who is not as efficacious in this dimension. Similarly, a coach who is highly efficacious in building relationships that result in teacher change may exhibit different behaviors than a coach who, although highly efficacious in mathematics-specific content and pedagogy, feels ineffective in transforming the practices of teachers that they coach. Such beliefs about one's inability to affect instructional change can negatively influence an instructional coach's effort, behavior, and other outcomes. Hence, instructional coaching efficacies significantly drive instructional coach outcomes.

Sources and dimensions. Similar to numerous studies that have found a direct link between educational training and teacher efficacy (Duran, Duran, Haney, & Beltyukova, 2008; Hall, 2008), several authors posit that education, preparation, experience, and/or prior successes are important sources of coach efficacy information and coach efficacy (Corcoran & Feltz, 1993; Feltz et al., 1999; Malete & Feltz, 2000). Most notably, each of the aforementioned sources create a sense of efficacy, through what Bandura (1977) refers to as "mastery experiences," better known as first-hand experiences. This notion of personal mastery experience is aligned with the idea that the more success one experiences in a particular task, the more robust one's beliefs about their ability to complete such a task becomes (Bandura, 1994). Drawing upon this notion, the more knowledgeable and/or successful a teacher is in employing reform oriented teaching strategies, the more apt they may be in implementing reform strategies, which are

perhaps not aligned with their developing understandings of mathematics teaching and learning. Similarly, the more knowledge and success an instructional coach experiences in transforming teaching practices of resistant teachers, the more confident they may be in their ability to transform even the most difficult teacher's instructional practices. This is explained by Bandura and Adams' (1977) proposal that, "…perceived self-efficacy affects people's choice of activities and behavioral settings, how much effort they expend, and how long they will persist in the face of obstacles and aversive experiences" (pp. 287-288). Because Bandura (1977) identifies mastery experiences as most dependable in forming efficacy judgments, Feltz et al. (1999) theorizes that education/preparation, experience, and prior success are the strongest predictors of coaching efficacy. Therefore, primary sources of Instructional Coaching Efficacy are education/preparation, and past teaching and coaching experience.

In addition to education/preparation, experience, and prior success, Feltz et al. (1999) also identifies sports coach perceptions of player athletic ability as an important source of coaching efficacy. Because self-efficacy beliefs are not merely judgments about one's skill, but more so one's perception about what one can do with those skills (Bandura, 1986), perceptions of a team player, or a teacher's ability is instrumental in influencing a coach's view of whether they can or cannot produce positive outcomes. Parallel to the role that teachers' perceptions of students' academic ability play in teaching-efficacy, sport coach's perception of player ability has a significant impact on their coaching efficacy. Specifically, a sports coach who has experienced high success rates with a top performing team of seasoned athletes may feel very confident in their skills; however, when challenged to lead a team of novice players to victory, the same

coach may experience a decrease in confidence in their ability to lead a less experienced team. Due to a lack of direct exposure to leading a team of inexperienced athletes, and/or vicarious observations of other similar sports coaches' lack of success with inexperienced athletes and teams, a highly efficacious sports coach in one instance may not be so efficacious in another context. Therefore, in addition to education/preparation, and experience, an instructional coach's perception of the ability of the teachers under their instruction is also an important source of *Instructional Coaching Efficacy*.

Social persuasion is another method for increasing one's belief that one has what it takes to be successful and to successfully accomplish a goal (Bandura, 1977). Though originally not thought to be one of the stronger predictors of sport coaching efficacy, findings have proven otherwise. According to Feltz et al. (1999), perceived community support, years of experience coaching sports, and personal beliefs in team ability contribute to sport coach confidence more than prior year's won-lost record and parental support. Therefore, the level of support, appreciation, encouragement, and praise that an instructional coach receives from their administrative/leadership team, mathematics department, teachers and other key stakeholders are also significant sources of instructional coach efficacy.

In summary, several studies support the notion that various sources drive coaching efficacy. Whether it is education/preparation, past and/or present coaching experiences, perceived ability of learner, or perceived level of support, all of the aforementioned sources are to some extent related to coaching efficacy (Feltz et. al., 1999; Hoy & Woolfolk, 1993; Marback, Short, Short, & Sullivan, 2005; Myers et al., 2005; Park, 1992; Short, Smiley, & Ross-Stewart, 2005). Therefore, education (degree

level and degree major); experience as a teacher and instructional coach; perception of teachers' ability; and school/leadership support, are significant sources of instructional coaching efficacy.

Dimensions and Outcomes. Dimensions of coaching efficacy, in the context of sports, influence coach behavior, player performance, how confident and motivated players are (player efficacy), and how satisfied a player is with their coach (player satisfaction), (Feltz et al., 1999). Findings of research conducted on approximately thirty high school basketball coaches showed that high efficacy coaches had higher winning percentages and levels of player satisfaction, and employed more effective coaching behaviors, than did their lower efficacy counterparts (Feltz et al., 1999). This supports the authors' theory that coaching efficacy is an important variable in coaching effectiveness. Analogous to the theory of Coaching Efficacy, Instructional Coaching Efficacy influence instructional coach behavior, instructional coach impact on teacher practices (coach impact), and teacher satisfaction with their instructional coach (see Figure 2).

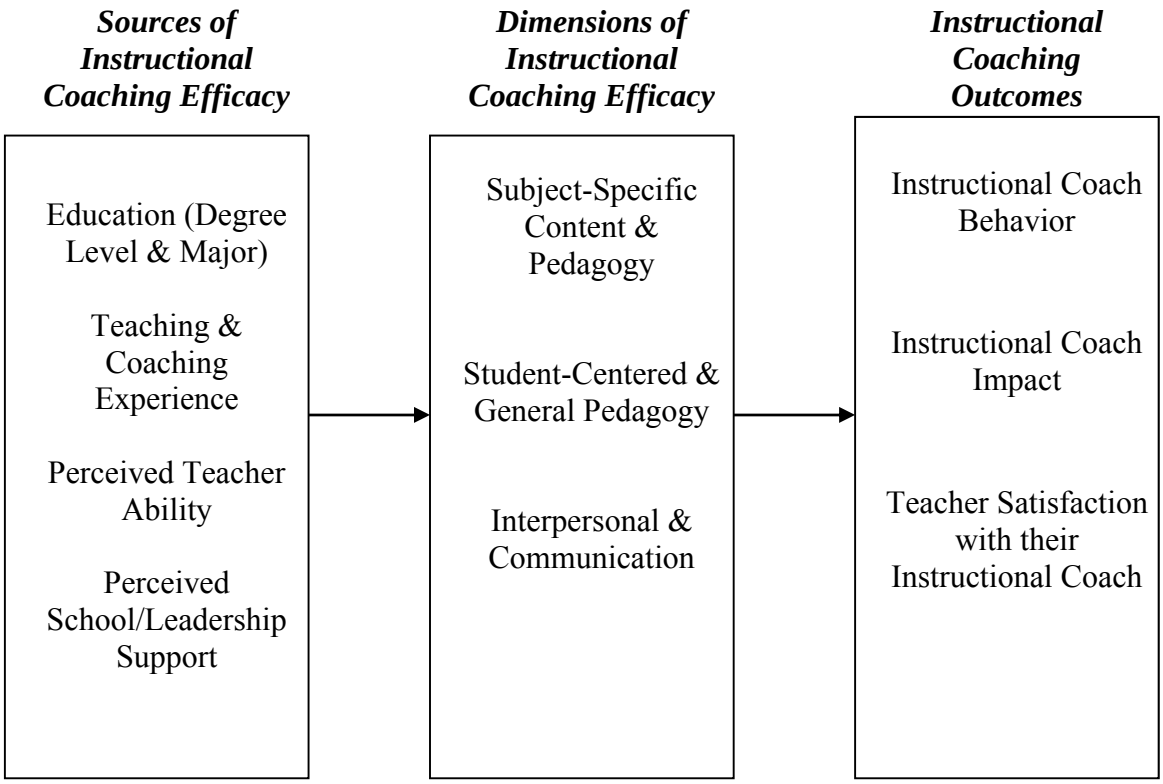

Figure 2. Conceptual model of instructional coaching efficacy.

It is important to note that Figure 2 is only a model; and therefore, models leave out paths, variables, and relationships. Although Figure 2 implies that only unidirectional relationships exist between sources of instructional coaching efficacy, dimensions of instructional coaching efficacy, and instructional coach outcomes, bidirectional relationships are embedded. For instance, one might argue that teacher satisfaction (instructional coach outcome) has just as much of an influence on dimensions of instructional coach efficacy as dimensions of instructional coach efficacy has on teacher satisfaction. Figure 2 accounts for this bidirectional relationship by the source, teaching and coaching experience. Such experiences are products of previous instructional coaching outcomes.

CHAPTER 2

Review of the Literature

There is very little question that coaching, when done effectively, can promote teachers' effective implementation of curriculum reform (Bruce & Ross, 2008; Campbell & Malkus, 2009; Wang, Lin, & Spalding, 2008). Despite positive coaching outcomes, the extant research findings are inconsistent. Conclusions drawn by many researchers highlight the important role that the 'coach' plays in determining these varied outcomes (Campbell & Malkus, 2009; Manno & Firestone, 2008; Taylor, 2008). Of particular interest is the emerging line of research that highlights the role that individual coach characteristics play in influencing coach effectiveness. Recent studies have postulated a relationship between coach expertise and their effectiveness (Manno & Firestone, 2008). Therefore, an exploration of forces that drive individual coach characteristics that result in coach behaviors/outcomes that are related to desired reform outcomes, may be beneficial to the mathematics education field.

In efforts to identify linkages amongst the coach, their behavior, and their effectiveness in driving forward reform efforts, the present study aims to answer the questions whether such relationships exist. In defining the dimensions of coaching efficacy, as it relates to effective instructional coaching, I will employ a backwards approach in reviewing the literature. In doing so, my goal is to first identify effective professional development conditions that promote teachers' implementation of reform-based instruction. This will allow for a better understanding of the types of behaviors that coaches must exhibit in order to be effective. Consequently, identification of such behaviors will result in the selection of coaching dimensions, assuming a direct

relationship between efficacy and behavior (Bandura, 1977). Furthermore, a literature review of most recent research on coaching efficacy will conclude this chapter.

Characteristics of Effective Professional Development

Continuing education is big business in the United States, as evidenced by the billions of dollars that have been allocated by state and federal agencies throughout the years (Hill, 2009). With approximately 1-6% of district expenditures also being spent on professional development (Hertert, 1997; Killeen, Monk, & Plecki, 2002; Odden, Archibald, Fermanich, & Gallagher, 2002; Miles, 2003), there's no wonder why school and district leaders, as well as researchers, are looking to providers for evidence that what they are doing is actually helping teacher practice and student learning (Borko, 2004; Fishman, Marx, Best, & Tal, 2003; Penuel et al., 2007). Therefore, a plethora of research on the effects of professional development exists and continues to emerge; frequently noting conducting school or site-based professional development, providing sufficient time and other resources, enhancing teachers' content and pedagogy, and promoting collegial and collaborative exchange, as essential elements of effective professional development. There are four characteristics cited in the literature concerning effective professional development. These are form, time and duration, collegiality, and activity/content of professional development.

Form. What matters most is that teachers transfer newly learned skills to the classroom. In understanding how to better assist teachers in doing so, much has been learned about the important role that the form of professional development plays in teachers' ability and motivation to transfer new processes to the classroom. For several

decades, research has accentuated the idea that the intensive, short-term workshops are very ineffective without additional job-embedded relevant professional development.

This notion is supported by studies such as Bush's (1984) investigation of teachers' transfer of strategies learned during a workshop into their classroom instruction. Findings from this study revealed that approximately 95% of the teachers − provided with additional site-based support for their efforts to take back, adapt and implement innovations learned during the workshop − actually adopted these strategies in their classes. This likelihood is remarkable; given the fact that, without such support, fewer than 20% of the teachers exhibited that attitude. Based on different professional development approaches, the proportion of teachers who actually took newly learned skills back to their classrooms were: 10% for teachers who were only presented with the theoretical and conceptual base for the new procedures; 12 to 13% for those who received both theory and modeled examples and demonstrations; 14 to16% for teachers who were offered theory, modeled demonstrations, and opportunities to practice new procedures in a controlled setting; and 16-19% for teachers who were provided instruction that included theory, modeling, practice, and feedback. Studies such as this one really bring home the key role that job-embedded professional development, specifically coaching, plays in teachers' transfer of newly learned teaching strategies to their classrooms (Joyce & Showers, 1981, 1982).

Throughout the decades, research has continued to accentuate the important impact that site-based support, now known as reform-oriented professional development activities, has on teachers' employment of innovations. Though findings appear unchanged, what has evolved is a more defined description of site-based support, which

is defined by Garet, Porter, Desimone, Birman, and Yoon (2001) as reform-oriented activities that include being mentored or coached. Studies that are more recent have attempted to answer the ubiquitous question of why many US teachers continue to employ traditional methods of instruction despite a history of reform that warns against it.

In search for answers, Truesdale (2003) investigated whether a difference existed in the level at which a peer coached teacher, in comparison to a non-coached teacher, transferred new professional development to the classroom. Findings from this study confirmed that teachers who received peer coaching, in addition to the workshop, had a higher incidence of transferability of professional development than their counterparts. Furthermore, teachers who only participated in the workshop showed no significant increases in their skill level, from pre- to post-test (Truesdale, 2003). Of particular importance, is the idea that the coached teachers identified their ability to 'practice' what they had learned in the professional development, feedback received from peer observations, and opportunities to reflect and discuss their practices, as key contributors to their transfer of information gathered during the workshop presentation.

Similarly, Cornett and Knight (2008) also found that instructional coaching is an additional support that will increase teachers' transfer of knowledge into practice. Through their study of fifty urban teachers' implementation of proven practices learned in a professional development workshop, they found that teachers assigned to receive additional coaching support, following workshop participation, implemented new teaching practices with a higher level of quality. Furthermore, many of the teachers receiving additional support continued to use the new teaching practices 'more frequently' than did teachers who only attended the workshop. This is not a new finding.

Researchers have been alarmingly aware that significant improvements in teacher practice and classroom transfer requires additional job-embedded support (Bruce & Ross, 2008; Campbell & Malkus, 2009; Collopy, 2003; Darling-Hammond & Richardson, 2009; Foster & Noyce, 2004; Garet et al., 2001; Greene, 2004; Guskey, 2003; Hubbard et al., 2006; Cornett &Knight, 2008; Murray, Ma, & Mazur, 2008; Penuel et al., 2007; Roehrig et al., 2007; Truesdale, 2003; Yoon, Duncan, Lee, Scarloss, & Shapley, 2007).

These and other findings support the notion that traditional methods of professional development, relying on intensive and short training programs 'alone', are ineffective in increasing teachers' implementation of mathematics reform. However, it needs to be emphasized that merely employing reform-oriented methods for professional development does not guarantee effective professional development (Campbell & Malkus, 2009; Guskey, 2003; Penuel et al., 2007; Perkins, 1998; Roehrig et al., 2007). Unfortunately, the latter has yet to be realized by many school and district leaders who haphazardly invest millions of dollars in reform-oriented supports with high hopes of an asset return (Corcoran, 1995). Trusting these results, with little knowledge of the specific conditions that foster effective use, is probably the reason why so many school districts are left scratching their heads when trying to determine why merely placing a coach in their building is not working.

Despite the positive implications of findings that highlight the important role that 'form' of professional development plays in increasing the likelihood that teachers transfer new knowledge to their classroom practices, these characteristics "…guarantee neither high quality nor substantive effects on teachers' teaching and learning" (Hill, 2009, p. 471). A deeper analysis of research on professional development, which

specifically affects student achievement, has shed a new light on previous research findings. For instance, findings from a review of nine rigorous studies, in which professional development effected student achievement, highlighted the emerging idea that traditional professional development is not necessarily an ineffective approach to professional development as previously thought (Yoon et al., 2007; Guskey &Yoon, 2009). This notion is troubling for many who favor reform-oriented professional development, such as site based mentoring, coaching, professional learning communities, etc., over traditional workshop settings. However, what Yoon et al. (2007) and Guskey and Yoon (2009) have taken special care to highlight is that the 'focus' of the professional development, the 'expertise' of the provider, the effective 'use of time,' and 'structured and sustained' follow-up support are much more important than the 'location' or the 'form' of professional training. Therefore, professional development workshops can be just as effective as reform-oriented approaches given certain conditions.

Time and duration. One thing is certain, teachers are very reluctant to relinquish their beliefs about teaching and learning, formed through their own experiences as students (Lortie, 1975; Nespor, 1987; Pajares, 1992). Because curriculum reforms are very demanding and require teachers to make considerable changes in order to implement them well (Crawford, 2000), it is unreasonable to believe that a 'quick' and intensive workshop will bring about such changes. Past lessons have revealed that change in teachers' attitudes takes time. Therefore, it is not surprising that the duration of professional development is significantly related to the extent and effectiveness of teacher change (Shields, Marsh, & Adelman, 1998; Weiss, Montgomery, Ridgway, & Bond, 1998).

In a national sample of 1,027 mathematics and science teachers, Garet and colleagues (2001) found that the duration of training most likely impacted teachers' learning because it provided more time for teachers to actively engage in reform oriented activities that involved cycles of class implementation, opportunities to observe and be observed, reflection and feedback, and presentations and demonstrations. Other similar studies also conclude that longer duration and time span yields the opportunity for teachers to integrate the new knowledge into their teaching (Brown, 2004; Garet et al., 2001) through cycles of presentation and assimilation of knowledge, as well as reflection (Blumenfeld, Soloway, Marx, Guzdial, & Palincsar, 1991; Kubitskey, 2006; Penuel et al., 2007).

Alongside duration, the amount of time/contact hours that teachers spend in professional development also has positive benefits. Teachers who spend more time in 'targeted' professional development become more apt to transfer new knowledge. This is most evident in studies that reveal a direct relationship between time spent in professional development and teachers' use of reform-based teaching strategies. According to a study of this type, teachers who spent eighty or more hours in professional development were significantly more likely to implement inquiry-based teaching than their counterparts who were given less training (Corcoran, McVay, & Riordon, 2003). Closely aligned to these findings, other studies confirm the existence of a positive relationship between teachers' time spent in professional development and their implementation of reform-based teaching (Supovitz & Turner, 2000), resulting in the improvement in student achievement (Banilower, 2002).

Despite the empirical evidence of positive relationships between teacher time spent in professional development and improvements in teacher instruction, the findings in support of this notion have been inconsistent. Contrary to previous findings, Kennedy (1998) found that contact hours or the duration of professional development is not always related to effective professional development; in that, several professional developments that required fewer contact hours had greater impact on student achievement than did those requiring extensive contact. Similarly, in a study in which teachers received professional development in an effort to support their implementation of an inquiry-based science reform, a negative relationship was also found between time and duration of professional support and teachers' use of student inquiry during instruction (Penuel et al., 2007). Researchers attributed these inconsistent findings to school-based partners, who did not effectively focus on student inquiry during support sessions.

Although a vast majority of studies report that time and duration are critical characteristics of effective professional development, other studies have concluded that "…while effective professional development surely requires time, it's clear that the time must be well organized, carefully structured, and purposefully directed" (Guskey, 2003, p. 749). These findings accentuate the idea that more is not always better, implying that the duration of professional development is not as significant as its content and effective use of the allocated time. If used inappropriately, time and duration may not be a characteristic solely devoted to effective professional development. Therefore, these findings continue to emphasize the idea that certain conditions must exist in order for identified characteristics to truly determine whether a professional development endeavor will be effective.

Collegiality. A critical component of effective professional development lies in the power of collaboration. In a sample of twenty-two teachers, who received professional development on Cognitively Guided Instruction, many of the teachers reported that the level of support that they received from their colleagues was critical to their sustained improvement (Franke, Carpenter, Levi, & Fennema, 2001). Some even went so far as to say that it would be extremely difficult to continue implementing the reform without collegiality from their peers. Similarly, a study conducted by Bruce and Ross (2008) found that "…when a teacher receives positive and constructive feedback from a respected peer, there is even greater potential for enhanced goal setting, motivation to take risks, and implementation of challenging teaching strategies" (p. 348). Teachers value and learn from knowledgeable peers who they feel can 'relate' to their specific teaching context, and who offer meaningful feedback. According to Bruce and Ross (2008), intense reflection with, and feedback from, a peer coach resulted in teachers' implementation of reform at a higher quality. It is most important to note that teachers who receive support from colleagues who are experts in their content area tend to gain new information (Penuel et al., 2007). Additionally, when this support allows time for discussion and reflection, as it relates to teachers' daily instruction, such collaboration is very beneficial.

In spite of findings that emphasize the importance of collegiality in teachers' increased adoption and effective implementation of mathematics reform, it is only beneficial if certain conditions are met; for example, internal supporters must possess a level of 'expertise' that fosters new learning, reflection and feedback that is meaningful and helpful to teachers' improved implementation of mathematics reform curriculum.

Theoretically speaking, mathematics leaders should be able to support collective collaboration through 'critical collegiality' (Lord, 1994) and well structured opportunities for teachers to engage and reflect on student learning. When this is not the case, the collective collaboration tends to serve as an arena for teachers to talk about topics that are unfocused and unrelated to student learning (Franke et al., 2001; Roehrig et al., 2007). Therefore, rather than merely 'collectively' meeting; the structure, purpose, goal, and focus of collaborative efforts must take precedence in order for true teacher and student learning to occur (Darling-Hammond & Richardson, 2009; Guskey, 2003; Roehrig et al., 2007).

This need is further echoed by teachers who voice their desire for experts and other 'knowledgeable' teachers as collaborative supporters. Specifically, in a study documenting professional development that supports sustained change, a teacher confirmed this need for internal expertise as a condition of effective collegiality in her statement, "I'm really not sure it's the bouncing of what kids are doing with another colleague as much as I think it helps to bounce it off someone who really has knowledge about kids' thinking" (Franke et al., 2001, p. 681). Furthermore, in a study on the impact of school and teacher characteristics on the implementation of a reform-based science curriculum, it was found that collaborative efforts within schools that did not have a dedicated science administrator did not focus on classroom practices and student learning. Hence, a precursor for effective collegiality is the presence of knowledgeable individuals who are capable of supporting the facilitation of such work.

Content (Topics). It is widely recognized that teachers tend to teach mathematics the way in which they were taught (Kennedy, 1991b; Lortie, 1975; Nespor, 1987;

Pajares, 1992). One issue with this conclusion is that, in many cases, the ways in which teachers learned mathematics when they were students is in direct contrast to the proposed modern teaching methods. This dilemma has resulted in the need for effective professional development activities that support teachers as they navigate these uncharted waters.

"Helping teachers to understand more deeply the content they teach and the ways students learn that content appear to be a vital dimension of effective professional development" (Guskey, 2003, p. 749). Because mathematics reform curriculum calls for teachers to teach mathematics both conceptually and procedurally, merely teaching division of fractions procedurally is no longer acceptable. Despite teachers' awareness of the need to teach students mathematics for 'understanding', a certain level of frustration exists for many teachers who themselves did not learn how to conceptually explain procedural algorithms such as 'multiply by the reciprocal'. In the absence of professional support, particularly mathematics coaching, many teachers will "…either not try it because it is just too difficult, or they will try to do better what they have always done rather than changing" (Guiney, 2001, p. 742). Therefore, in order to 'transform' instructional practice, teachers require support in conceptually developing mathematical principles, connecting concrete experiences to abstract algorithms, using manipulative materials, and other aspects of class preparation and instruction. When teachers are provided access to such powerful alternatives, "…[they have] the means to make changes" (Bruce & Ross, 2008, p. 348). Many studies support this notion by accentuating findings that identify activities focused around enhancing teachers' content and

pedagogical knowledge as key in teachers' instructional change (Chval, Abell, Pareja, & Ritzka, 2008; Garet et al., 2001; Rogers et al., 2007; Snow-Renner & Lauer, 2005).

Studies have confirmed that teachers' instructional implementation is positively related to the support that they receive on the use of materials that are 'specific' to a particular curriculum (Chval et al., 2008; Hill, Rowan, & Ball, 2005; Penuel et al., 2007). In a study of the impact of professional development on teachers' implementation of a science curriculum, findings revealed that teachers who received explicit professional development on the use of particular science resources were more likely to use these innovations (Peneul et al.). Conversely, in a review of several professional development programs, Kennedy (1998) found that when the content of a professional development focus on 'teaching behaviors', as opposed to "teachers' knowledge of the subject, on the curriculum, or on how students learn the subject" (p. 17), the impact on student learning is not as significant.

Similarly, Bruce and Ross (2008) concluded that, despite the reform-oriented structure of their professional development, it is highly probable that teachers did not experience significant growth in their construction of knowledge because the content of the professional development was not 'focused' in this area. From these and other studies, it is implied that the 'content' that is discussed during professional development is much more a determinant of teachers' transfer of newly learned skills than the 'form', 'allotted time and duration', and other structural and organizational features. Therefore, if teacher instructional change is the goal, then subject-matter content and pedagogy must be the focus.

In addition to providing teachers with opportunities to engage in activities that enhance teacher content and pedagogical knowledge, it is especially important that providers of professional development create and foster opportunities for teachers to link new alternative strategies to their pre-existing knowledge base (Lampert & Ball, 1998). "If [teachers] learn a series of specific teaching techniques without understanding their rationale and without help adapting them to particular students and classroom situations, they will be unable to make lasting changes in their practice" (Kennedy, 1991b, p. 17). In promoting such changes, effective professional development must include opportunities for teachers to enhance their conceptual understandings of content (Roehg & Kruse, 2005), 'enact' pedagogical strategies, and use materials specific to a particular curriculum (Hill et al., 2005; Peneul et al., 2007). Such interactive learning allows teachers time to make the changes, advocated by reform, through "…multiple cycles of presentation and assimilation of, and reflection on, knowledge" (Peneul et al., p. 929). Aligned with these findings, many teachers' value opportunities to actively engage in relevant tasks that are aligned with a specific grade level curriculum, discuss student thinking, and reflect on instructional strategies for addressing such thinking as key in changing their practice (Chval et al., 2008; Kennedy, 1998).

Whether it is an algebra tile, balance beam, 2-color counter, or fraction cake, teachers require explicit support on the use of these resources and understanding of their relation to their current knowledge and skills. In order to positively impact teachers' instruction, the 'content' of professional development must be coherently aligned to curriculum; applicable to the diverse academic needs of students; target improvement to content and pedagogical knowledge; and provide teachers with the necessary tools that

support them in successfully implementing mathematics instruction (Darling-Hammond & Richardson, 2009; Garet et al., 2001; Porter, Garet, Desimone, & Birman, 2003; Rogers et al., 2007; Saxe, Gearhart, & Nasir, 2001; Guskey &Yoon, 2009). Therefore, it is critical that providers of professional development not only specialize in mathematics content and general pedagogy, but they must also be curriculum specialists, able to support teachers in the context of their individual domains. Hence, beyond content and pedagogy, providers must know the underlying principals of the curriculum that they support and the pedagogical content knowledge that is immersed in it. This condition is necessary; otherwise, merely exposing teachers to new subject matter and pedagogy without effectively facilitating their understanding as it relates to their curriculum context is a recipe for 'ineffective implementation'.

Characteristics of Effective Professional Developers (Mathematics Coaches)

Despite the saturated professional development market, many providers do not possess the capacity needed to support mathematics reform efforts (Hill, 2005). Surprisingly, a survey of mathematics professional development providers revealed that in some instances their knowledge of mathematics was far below that of their teacher audience (Hill, 2005). Similarly, Bach and Supovitz (2003) found that the fidelity with which coaches were implementing workshops was no greater than that of their teachers. This draws great attention to the role that providers of professional development play in catalyzing the impact of professional development. Therefore, aligned with characteristics of effective professional development, it is critical that professional developers themselves understand the intent of program and curriculum authors, theory and underlying principles behind content and pedagogy, how to create professional

development opportunities that effectively foster such understandings, and how to promote healthy relationships and lines of communication. As a result of growing research, there are four key areas that instructional coaches should be an expert in: Curriculum, Subject-specific Content and Pedagogy, General/Student Centered Pedagogy, and Building Relationships (Interpersonal Communication).

Curriculum Expertise. In an exploration of professional development that promotes reform implementation, researchers found that provider 'curriculum expertise' was a key factor in determining the extent to which teachers implemented various program components (Penuel et al., 2007). In contrast to the positive effect increased contact hours with university-based partners produced, Penuel et al. (2007) found that allotting more time for teachers to participate in professional development facilitated by school-based partners negatively impacted teachers' implementation of student inquiry. In efforts to answer the question of why such differences existed between the university- and school-based partners, the authors concluded that because university-based partners authored the curriculum they tended to do a better job than school-based partners did in supporting curriculum implementation. Furthermore, this may explain the notion that site-based staff members and leaders tend to make decisions that are aligned with what they are already doing with little regard for research and or strategies that produce results (Guskey, 2003). Consequently, in order to affect teachers' implementation of research based mathematics reform curriculum, professional developers must possess a clear understanding of the 'intent' of authors of reform curriculum, be competent, open minded, willing and capable of supporting innovations that are a departure from their

own understandings about the teaching and learning of mathematics (Penuel et al., 2007; Guskey & Yoon, 2009).

In support of the idea that effective professional developers must possess curriculum expertise, several studies point out the benefits of having program authors, and researchers directly support teachers in their implementation. Because curriculum reforms are demanding, and a great leap from how teachers themselves learned mathematics, it is important that teachers be provided with support that assists them in understanding the purpose, rationale, and theory behind innovations. Without this understanding, it is very likely that teachers will become confused and frustrated by reform curriculum and as a result implement innovations at a very low level (Joyce & Showers, 1981). Furthermore, it is highly unlikely that a professional developer who lacks curriculum expertise will be effective in selecting and facilitating 'relevant' content discussions that support teachers in effectively implementing a particular curriculum. For this reason, it is important that teachers receive professional development from individuals who understand the theory behind newly introduced teaching approaches, in an effort to develop teachers' skills and increase their implementation of what can be demanding and confusing curriculum.

Such knowledge of the goals and agenda of specific curriculum is needed "In order to know where the discontinuities lie between participants' goals and those of the curriculum" (Schifter & Lester, 2003, p. 14). Identifying such discontinuities is a starting point for effective instructional coaches, who use this information to set targeted professional development goals in efforts to foster teacher learning. With such knowledge, instructional coaches are able to choose appropriate courses of actions that

both connect with teacher current understandings and in turn challenge their professional growth. Therefore, professional developers must be well versed in their schools' curriculum in order to effectively support teachers and align curriculum to school, district, state and national standards.

Content and Pedagogy Expertise. "The problem is not that we lack promising programs, formats, or content; [but]…that they rarely reach the typical teacher in a form that maintains their integrity and effect." (Hill, 2009, p. 472) Therefore, it is critical that highly skilled and competent professional developers are selected to do so. According to a review on characteristics of successful mathematics coaches, "Effective instructional coaches, no matter their subject area, have a thorough understanding of the subject they are coaching as well as familiarity with the curriculum that teachers are currently using" (Kowal & Stein, 2007, p. 4). Again, this supports the notion that be it a program author, peer coach, or a teacher, the requirement of competence must be present in order for the professional development to be effective. For this reason, it is critical that instructional coaches, and other providers of professional development, are content and curriculum specialists, who are capable of supporting teachers in understanding the content of the curriculum (Kinkead, 2007). Furthermore, in order for teachers to acquire the pedagogical strategies needed to effectively implement mathematics reform, they must receive professional development from effective mathematics coaches who "…have a thorough understanding of how children learn and are skilled in developing and implementing instructional strategies" (Kowal & Stein, p. 4).

Beyond possessing necessary content and pedagogical expertise (Borman & Feger, 2006; Kinkead, 2007; Knight, 2004b; Kowal & Stein, 2007; Poglinco & Bach,

2004; Saphier & West, 2010; West & Staub, 2003), effective professional developers must also be capable of creating teacher dissonance, understanding teacher thinking patterns and difficulties, and facilitating learning opportunities that support teachers in transforming their practices, especially in instances in which content sharply deviates from teachers' current understandings (Schifter & Lester, 2003). West and Staub (2003) confirm this notion, highlighting the idea that effective coaches are 'expertly attuned' to "diagnosing teachers' needs" (p. 19) and making necessary adjustments that address and support teachers' particular instructional needs within the classroom. In order to effectively do so, professional developers, such as mathematics coaches, must be content, pedagogy, and curriculum specialists (Borman & Feger, 2006; Feger, Woleck, & Hickman, 2004; Knight, 2004a; Schifter & Lester, 2003). Specifically, effective mathematics coaches are knowledgeable of the curriculum that they support and use it to support teachers' development of content and pedagogical knowledge (Borman & Feger).

Interpersonal and Communication Skill. In addition to competence, critical characteristics of effective professional development providers are interpersonal and communication skills (Borman & Feger, 2006; Guiney, 2001; Killion & Harrison, 2005; Kinkead, 2007). According to research on successful coaches, effective instructional coaches actively listen and employ reflective questioning strategies, provide critical feedback that help teachers improve, build trusting relationships, foster safe learning environments, and effectively communicate with school personnel (Kinkead). Akin to these findings, in a survey of 31 professional development coaches, Kowal & Stein (2007) found that "…the most frequently mentioned characteristic of an effective coach was 'people skills,' including the ability to build relationships, establish trust and

credibility, and tailor assistance to individual educators' needs" (p. 4). Such skills are pre-requisite to the position of a 'change agent'. Despite subject-specific expertise, instructional coaches who lack effective interpersonal and communication skills may be ineffective in transferring their wealth of knowledge to teachers.

Though not often emphasized, credibility is critical to the effectiveness of coaches; in that, teachers tend to value feedback from competent leaders who have demonstrated success as a mathematics teacher (Bruce & Ross, 2008; Franke et al., 2001). A coaches' inability to foster healthy relationships that promote effective communication can result in ineffective coaching outcomes (Perkins, 1998). This was observed in a case study of six teachers where ineffective communication skills hindered effective peer coaching (Perkins). Therefore, a significant characteristic of an effective instructional coach is their propensity to foster trusting relationships through effective communication channels.

Synthesis

The popular cliché, "…it's not what you do but how you do it" is very relevant to the work of instructional coaching. It appears that, more so than "conducting school or site-based professional development," "providing sufficient time and other resources," "enhancing teachers' content and pedagogy," and "promoting collegial and collaborative exchange," the quality and "capacity of providers" of professional development is of much greater importance (Guskey, 2003; Hill, 2009; Yoon & Guskey, 2009). If nothing else, this literature review has consistently emphasized the active role that coaches play in professional development. Just as a vehicle is not very useful without a driver, professional development is futile without providers who direct the work. Along these

lines, from this and other reviews, it is unquestionable that professional developers must be experts in content & pedagogy, curriculum, and interpersonal communication (Borman & Feger, 2006; Feger et al., 2004; Kinkead, 2007; Knight, 2004b; Kowal & Stein, 2007; Saphier & West, 2010; West & Staub, 2003). Without such coach characteristics, professional development will continue to produce the same unsatisfactory outcomes.

As coaching has only recently arrived at the professional scene, I have selected to specifically focus my attention on this promising, yet under-researched (Taylor, 2008) professional development strategy. In efforts to establish dimensions that are relevant to instructional coach efficacy, a review of effective coach characteristics and behaviors has been conducted, yielding enough information to confirm critical dimensions of instructional coaching efficacy. With this information, I plan to explore the extent to which particular sources influence dimensions of instructional coaching efficacy; and, in turn, the extent to which dimensions of instructional coaching efficacy are associated with instructional coach effectiveness. Similar to Feltz and Largg's (2001) call for investigations that focus on understanding coach characteristics in relation to their sport teams' performance, I feel that it is necessary to explore similar relationships in the context of mathematics education. Therefore, understanding the conditions that influence individual characteristics of effective providers of professional development is of critical importance.

CHAPTER 3

Methodology

In an effort to gain more insight into the driving forces that impact instructional coach outcomes and effectiveness, this study: a) explored the relationship between sources of instructional coaching efficacy and dimensions of instructional coaching efficacy; and b) explored the relationship between dimensions of instructional coaching efficacy and instructional coach outcomes. In examining such relationships, the following research questions guided this study:

1. To what extent are the sources of instructional coaching efficacy associated with dimensions of instructional coaching efficacy?
2. To what extent are dimensions of instructional coach efficacy associated with instructional coach outcomes?

The research design used is a correlational design. Its purpose was to correlate instructional coach scores on responses from the items that assessed sources of instructional coaching efficacy with scores on responses from the items that assessed dimensions of coaching efficacy. Additionally, a canonical correlation analysis was used to explore the relationship between instructional coach scores on responses from the items that assessed dimensions of instructional coaching efficacy with teacher scores on responses from the items that assessed instructional coach outcomes. Multiple regression analysis was used to determine the extent to which dimensions of instructional coaching efficacy were related and predictive of instructional coach outcomes.

Hypothesis

In the process of conducting this exploratory research study, three hypotheses

were tested. First, this study hypothesized that interpersonal and communication coaching efficacy (IE), mathematics content and mathematics-pedagogy coaching efficacy (ME), and student-centered & general pedagogy coaching efficacy (SE), is predictive of instructional coach behavior. Secondly, this study also hypothesized that interpersonal and communication coaching efficacy (IE), mathematics content and mathematics-pedagogy coaching efficacy (ME), and student-centered & general pedagogy coaching efficacy (SE) is predictive of instructional coach impact. Lastly, this study hypothesized that interpersonal and communication coaching efficacy (IE), mathematics content and mathematics-pedagogy coaching efficacy (ME), and student-centered & general pedagogy coaching efficacy (SE) is predictive of teacher satisfaction with their instructional coach.

Method

Population

The participants in this study were limited to instructional coaches and their teachers from 55 elementary schools located within a large urban school district. For purposes of this study, the pseudonym Success County Schools will be used to refer to this large urban school district which is located in the southeastern region of the U.S. Over 95% of the schools that make up Success County Schools are Title I schools. Additionally, over 75% of the students are eligible for free and reduced priced meals. The average student teacher ratio in elementary classrooms is 18:1. Approximately 80% of the students in Success County Schools are African American; 10% are Caucasian; 5% Hispanic; and less than 5% for other races. Despite the fact that all schools in this district are encouraged to implement state reform standards and curriculum materials for

mathematics, select schools have been mandated to adopt a Comprehensive School Reform (CSR) model that would support them in closing achievement gaps in mathematics and reading.

Sample

Out of 55 elementary schools, instructional coaches from 36 elementary schools were invited to participate in this study. Out of 36 instructional coaches, 19 instructional coaches volunteered to participate in this study, yielding a 52.8% return; however, one of the 19 instructional coaches was a late responder. As a result, teachers from that school were not invited to participate due to time constraints. Therefore, a total of 418 elementary teachers (from the resulting 18 participating elementary schools) were invited to participate in this study. Out of 418 teachers invited to participate in the study, 186 teachers attempted to complete the Coach Effectiveness questionnaire, yielding a 44.5% return. However, only 144 elementary teachers submitted completed questionnaire responses, yielding a 34.4% return. Therefore, the actual sample was 19 instructional coaches, 19 schools, and 144 elementary teachers.

Participants

Nineteen instructional coaches volunteered to participate in this study. Of these instructional coaches, 3 were male (15.8%) and 16 were female (84.2%). The years of coaching experience ranged from 1 to 10 years (M = 8.74, SD = 6.02). All of the instructional coaches held post-baccalaureate degrees. Table 1 lists instructional coach demographics.

Table 1

Instructional Coach Demographics Data

Coach Demographics	% or Years
Sex	
Male	15.8%
Female	84.2%
Highest Degree Earned	
Bachelor's	0%
Master's	57.9%
Education Specialist	36.8%
Doctoral	6.3%
Years as a Coach	
≤3 years	79.0%
4-9 years	15.8%
10-19 years	5.3%
≥20 years	0%
Average years Of math teaching experience	8.74
Average years of coaching experience	2.68

Of the 144 elementary teachers who volunteered to participate, 14 were male (9.7%) and 130 were female (90.3%). Approximately 15.28% of the teachers were Kindergarten teachers; 11.11% were grade 1 teachers; 17.36% were grade 2 teachers; 16.67% were grade 3 teachers; 13.19% were grade 4 teachers; 17.36% were grade 5 teachers; and 9.03% were teachers who taught mathematics in multiple grade levels. The years of teaching experience ranged from 1 to 38 years (M = 14.14, SD = 9.37). Over 51% of the elementary teachers held a post-baccalaureate degree; however, 27.1% of the teachers elected not to identify the level of degree held. Therefore, the percentage of

teachers who held post-baccalaureate degrees may be higher. This sample of participants appears to be representative of the U.S. elementary teaching population (Aud et al., 2010). Table 2 lists all teacher characteristics and comparisons.

Table 2

United States (US) Teacher vs. Teacher Sample Demographic Data

	2007–08 US Public Elementary	2007–08 US Public Elementary (76–100% Approved Free & Reduced Lunch)	2011 Study Sample
Teacher Characteristic			
Sex			
Male	16.0%	16.4%	9.7%
Female	84.0%	83.6%	90.3%
Highest Degree Earned			
Bachelor's	49.6%	52.9%	21.5%
Master's	43.6%	40.2%	40.3%
Education Specialist	6.0%	5.9%	4.9%
Doctoral	0.5%	0.5%	6.3%
*No Response			27.1%
Years as a Teacher			
≤3 years	17.0%	21.2%	8.3%
4-9 years	28.0%	27.2%	18.1%
10-19 years	27.9%	26.5%	28.5%
≥20 years	27.0%	25.0%	18.1%
*No Response			27.1%
Average years of teaching experience	13.5	12.8	14.1

The number of elementary (K–5) teachers in each school ranged from 12–35 teachers (M = 23.22, SD = 7.46). The teacher to coach ratio ranged from 2:1 to 19:1 (M =

8, *SD* = 4.47). Table 3 lists each school's teacher response rate.

Table 3

Coach Effectiveness Questionnaire: Coach to Teacher Response Rate

	Coach to Teacher Response Rate			
Coach	1 Number of Teachers Invited	2 Number of Teacher Responses	3 Teacher-Coach Ratio	4 Response Rate (%)
1	14	2	2:1	14.29
2	33	19	19:1	57.58
3	14	2	2:1	14.29
4	20	4	4:1	20.00
5	27	7	7:1	25.93
6	19	3	3:1	15.79
7	31	12	12:1	38.71
8	18	9	9:1	50.00
9	35	8	8:1	22.86
10	24	9	9:1	37.50
11	19	8	8:1	42.11
12	17	7	7:1	41.18
13	18	7	7:1	38.89
14	23	9	9:1	39.13
15	31	16	16:1	51.61
16	33	10	10:1	30.30
17	30	8	8:1	26.67
18	12	4	4:1	33.33
19	-	-	-	-

Note. Teachers from Coach 19 school were not invited due to coach late response.

Data Collection Techniques & Instruments

One data collection technique was employed. An online survey was emailed via Survey Monkey in efforts to collect instructional coaches' responses to the Coach Efficacy Questionnaire and teachers' responses to the Coach Effectiveness Questionnaire. Coach Efficacy questionnaires were initially emailed to all instructional coaches. Instructional coaches were given a 3 week period to submit their responses to the Coach Efficacy questionnaire. Depending upon receipt of the completed Coach Efficacy questionnaire, teachers from schools in which a completed questionnaire had been submitted were simultaneously emailed the Coach Effectiveness Questionnaire. Teachers were given a date (4 weeks from the date that initial Coach Efficacy Questionnaires were emailed) by which to submit their responses to the Coach Effectiveness Questionnaire. This data collection technique was used to collect, manage, and download responses. Additionally, this technique was appropriate for both the collector and responder, had a date and time stamp, and was efficient in tracking and managing responders/non-responders and in sending reminder/follow-up emails.

Instruments for Data Collection

Two instruments were used to collect data. The Coach Efficacy Questionnaire was used to collect instructional coach self-reports of coaching efficacies. The Coach Effectiveness Questionnaire was used to collect data on teacher reports of instructional coach behaviors, instructional coach impact, and teacher satisfaction with their instructional coach.

Coach Efficacy Questionnaire. The Coach Efficacy Questionnaire consisted of 37 items adapted from Examining Mathematics Coaching (EMC) Coaching Skill Inventory

(Yopp, Burroughs, & Sutton, 2010a). Of the 37 items, 24 items assessed the dimensions of instructional coaching efficacy. Dimensions of instructional coaching efficacy were assessed on a 5-point Likert scale ranging from 1 (not at all effective/ confident) to 5 (very effective/confident). Of the remaining 13 items, 1 item assessed instructional coach perception of the ability of the teachers in which they coached, and 3 items assessed instructional coach perception of school/leadership support received. The item, 'From my perspective, my teachers' overall collective teaching ability is measured perceived teacher ability, and this was also assessed on a 5-point Likert scale ranging from 1 (very poor) to 5 (excellent). School/leadership support was measured by three items, which were very similar to the ones used by Feltz et al. (1999), in assessing coaches' perception of the level of support they received for their team from the athletic director, faculty, student body, athletes' parents, and the greater community. In assessing the level of support that instructional coaches received from their principals, members of their administrative team, and their teachers related to their ability to impact mathematics instruction, the following format of questioning was used, 'From my perspective, this year the _____(principal/members of the administrative team/teachers) has/have been_____.' Each of the items was scored on a 5-point Likert scale ranging from 1 (not at all supportive) to 5 (very supportive). Demographic information was solicited through 9 items, which provided data on gender; experience: years teaching and coaching; education: degree level and major; job/coaching assignment; and school curriculum/reform status. See Appendix B for items used to assess sources of instructional coaching efficacy and dimensions of instructional coaching efficacy.

Coach Effectiveness Questionnaire. The Coach Effectiveness Questionnaire

consisted of 51 items adapted from Examining Mathematics Coaching (EMC) Teacher Reflection and Impact Survey (Yopp, Burroughs, & Sutton, 2010b). Of the 51 items, 21 items assessed instructional coach interactions/behavior via content/topics teachers discussed during coaching sessions; 13 items assessed instructional coach impact on teacher instruction; and 7 items assessed teacher's satisfaction with their instructional coach. Items that assessed instructional coach interactions/behaviors were measured on a 5-point Likert scale ranging from 1 (never) to 5 (always). Instructional coach effectiveness was based on teachers' perceptions of the mathematics coaching they received from their coach, and was measured by the instructional coach outcomes, instructional coach impact, and their satisfaction with their instructional coach. A 6-point Likert scale, ranging from 0 (Didn't discuss, or not a topic of emphasis) to 5 (Very large impact) was used to measure instructional coach impact.

Seven items were used to assess teacher satisfaction with their instructional coach, and this was adapted from items from a scale intended, in part, to measure athlete's attitudes toward their coach (Smith, Smoll, & Curtis, 1978). A 5-point Likert scale ranging from 1 (not at all) to 5 (very much) was used to measure teacher satisfaction with their instructional coach.

Ten items were used to solicit demographic data, such as years teaching experience; grade level taught; number of years in which the teacher worked with their coach; school name; highest degree held; number of math courses taken for degree; and certification status. See Appendix D for the items used to assess instructional coach behavior, instructional coach impact, and teacher satisfaction with their instructional coach.

Response Rate

In efforts to increase response rates, several techniques were utilized. In establishing trust, a personal email invite was sent to each instructional coach and teacher, via their work email. This invitation included detailed study information, contact information for each investigator should the instructional coach have had questions, and attached letters of approval from the GSU IRB, school district, and their principal. Beyond establishing trust and making survey completion and return convenient, automatic email reminders were sent to both non- and partial-responders every 3 days for a 3-week period. Furthermore, $10 Wal-Mart e-gift card incentives were emailed to instructional coaches in exchange for their completion of the Coaching Efficacy Questionnaire. Dillman (2007) referred to this as social exchange and quoted, "Much research has shown that 'token' incentives given with the request to complete a questionnaire…consistently improve response rates" (p. 14). To address the issue of non-responder bias, initial respondents were compared with late respondents and no significant differences in responses were noted. Because late respondents are theorized to have similarities with non-respondents, differences between initial and late respondents were considered as an estimate of non-responder bias. Therefore, it can be concluded that a non-responders bias did not exist.

Procedure

Permission to conduct this study was first obtained through submittal of a research request application to the Department of Research Planning and Accountability within the Success County Schools System. Upon receipt and acceptable review of my research request, the Research Planning and Accountability department issued an official

letter granting permission to conduct research with the condition that research be limited only to those schools in which the building leader/principal also granted permission. In efforts to contact the correct individuals/principals in gaining school level permission to conduct research, a contact list was created in Microsoft Excel that listed the principals' first and last name, email address, school name, school address, telephone number, and instructional coach name. This information was gained from individual school websites, and confirmed via personal telephone calls to each school as well as crossed referenced with a contact information document received from a designated school district representative. This spreadsheet was used to email each principal a personally addressed letter requesting permission to conduct research. A copy of the district approval letter was also included in this email.

During the same time in which emails were sent to principals requesting permission to conduct research, approval from Georgia State University (GSU) Institutional Review Board (IRB) for Human Subjects was also sought. Once approval was received at the district, school, and university (IRB) levels, a subscription to Survey Monkey was purchased. This subscription allowed for the creation of survey instruments, and the collection, organization, and analysis of data. As a result, Survey Monkey was used to create the adapted Coach Efficacy questionnaire; however, questionnaire creation did not occur until after permission had been received via email from John Sutton to use portions of the items from the Coaching Skill Inventory (Yopp, Burroughs, & Sutton, 2010a) permission was requested via email from. Moreover, an address book was created in Survey Monkey which listed the names and email addresses for each instructional coach in which the principal granted permission to conduct research. This address book

was created by importing a Microsoft excel file that consisted of instructional coach names and email addresses. Once the Coach Efficacy questionnaire and the address book were created, an email invitation was created. This invitation and the Coach Efficacy questionnaire were emailed to each participating instructional coach via Survey Monkey. Because it was not possible to attach the consent letter to the email invitation sent by Survey Monkey, a separate email was drafted that explained the purpose and procedure of the present study. This email also contained information pertaining to instructional coach participation, rights and confidentiality, and included a letter of consent to participate. This separate email was sent to all 36 participating instructional coaches at least 1 hour prior to the initial Survey Monkey invitation. Follow-up emails were sent every 3 days until the 3 week collection period ended.

Teachers from each of the participating schools were also invited to participate. Similar to the procedures used with the instructional coaches, teacher's names, and email addresses were obtained from school websites and verified by designated school and/or district level representatives. This information was organized in a Microsoft excel file and exported to Survey Monkey, where a new address book was created for all participating teachers. The adapted Coach Effectiveness questionnaire creation did not occur until after permission had been received via email from John Sutton to use portions of the items from the Teacher Reflection and Impact Survey (Yopp, Burroughs, & Sutton, 2010b). The adapted Coach Effectiveness questionnaire and teacher survey were created in Survey Monkey and emailed to groups of teachers, upon receipt of their instructional coach's Coach Efficacy questionnaire. Prior to sending this teacher invitation, a separate email was drafted and sent to each selected teacher explaining the purpose and the

procedure of the research, as well as all information pertaining to their participation, rights, confidentiality, and consent. See Appendix A for survey invitation/email. Follow-up emails were sent every 3 days until the 3 week collection period ended, and teacher email inquiries were addressed on an individual basis.

At the end of the 3 week teacher data collection period, all survey responses were downloaded in Survey Monkey. Once all instructional coach and teacher data was downloaded, the data was saved as a Microsoft excel file and exported to SPSS 19.0 for further analysis.

Data Analysis

In this study, 3 methods of data analysis were employed: Pearson's and canonical correlation, principal component analysis, and reliability and validity analysis.

Pearson's Moment & Canonical Correlation

To assess the degree to which a relationship exists between sources of instructional coaching efficacy; perceived teacher ability; school/leadership support; math teaching (yrs) experience; math coaching (yrs) experience; education: degree level; and education: degree (math) major; and dimensions of instructional coaching efficacy (ME, SE, IE, and personal coach characteristics), canonical correlation was the preferred and most appropriate analysis. According to Sherry and Henson (2005), a canonical correlation is the most appropriate analysis when determining the magnitude of the linear relationships that may exist between two sets of variables, which in this case would have been sources of instructional coaching efficacy and dimensions of instructional coaching efficacy. However, canonical correlations require a sufficient number of observations per variable (Sherry & Henson, 2005). As a rule of thumb, 10 observations per variable are

advised in efforts to avoid "overfitting" the data. Due to small sample size (n=19), Pearson product-moment correlation coefficients were calculated. As Pearson correlation quantifies the strength and direction of relationship between two variables X and Y (Choudhury, 2009), this was the next best analysis for determining the relationship between each source of instructional coaching efficacy and each dimension of instructional coaching efficacy, given the limited sample of instructional coaches. This approach enabled the answering of the first research question, 'To what extent are the sources of instructional coaching efficacy associated with dimensions of instructional coaching efficacy?'

To assess the degree to which a relationship exists between instructional coach characteristics, as perceived by instructional coaches, and instructional coach outcomes, as perceived by teachers, canonical correlations were calculated. These correlations were used to answer the research question, 'To what extent are instructional coach characteristics associated with instructional coach outcomes?' Canonical correlation was the most appropriate analysis for answering this research question because "…it limit[s] the probability of committing Type I error anywhere in the study" (Thompson, 1991 as cited in Sherry & Henson, 2005, p. 38). Although a multiple regression analysis could have also been used to answer this research question, it was not the most appropriate analysis because it would have required three separate multiple regressions for each instructional coach outcome variable, resulting in an increase in the probability of a Type I error.

Principal Component Analysis

A principal component analysis was used as a reduction method in identifying

groups of observed variables that are empirically related. Principal component analysis was used, as oppose to principal factor analysis, because no underlying causal relationships were known or assumed. The data from the completed Coach Efficacy questionnaires were compiled and used to analyze the dimensionality of the 24 items. The initial extraction of the components resulted in 6 components. However, according to Hatcher (1994), four criteria should be considered in ultimately determining the number of 'meaningful' components: the eigenvalue-one criteria, the Scree test, the proportion of variance accounted for, and/or the interpretability criterion. The eigenvalue-one criteria confirmed the existence of 6 components; in which, there were 6 components with an eigenvalue greater than one. The value of 1 is used because each observed variable is said to contribute one unit of variance to the total variance in the data set. Therefore, an eigenvalue greater than 1 would constitute a meaningful amount of variance (Hatcher, 1994). The proportion of variance that each component accounted for in the total variance was also analyzed. According to Comrey and Lee (as cited in Tabachnick & Fidell, 2007), the amount of variance that a component should account for in order to be meaningful should be at least 10%. Based upon the percent of variances in Table 4, 5 components accounted for 10% or more of the total variance. All Eigenvalues and percents of variance are listed in Table 4.

Table 4

SPSS Output: Principal Component Analysis Table of Eigenvalues and Percents of Variance

Total Variance Explained

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	9.458	39.410	39.410	6.360	26.500	26.500
2	4.682	19.507	58.917	4.021	16.753	43.253
3	2.125	8.856	67.773	3.015	12.561	55.814
4	1.742	7.260	75.033	2.923	12.180	67.994
5	1.463	6.095	81.128	2.457	10.235	78.229
6	1.192	4.968	86.096	1.888	7.866	86.096
7	.901	3.755	89.850			
8	.677	2.819	92.669			
9	.419	1.747	94.416			
10	.390	1.626	96.042			
11	.292	1.218	97.260			
12	.217	.904	98.165			
13	.163	.681	98.846			
14	.150	.624	99.470			
15	.071	.296	99.765			
16	.030	.125	99.890			
17	.017	.070	99.960			
18	.009	.040	100.000			
19	5.585E-16	2.327E-15	100.000			
20	3.890E-16	1.621E-15	100.000			
21	8.066E-17	3.361E-16	100.000			
22	-1.136E-16	-4.732E-16	100.000			
23	-2.216E-16	-9.234E-16	100.000			
24	-8.197E-16	-3.415E-15	100.000			

Extraction Method: Principal Component Analysis.

In addition to the eigenvalue-one criteria and analysis of the proportion of variance, a Scree test was analyzed. With a Scree test, eigenvalues for each variable (item) are plotted and analyzed for ‘breaks’ (Cattell, 1966 as cited in Hatcher, 1994). According to Hatcher (1994), “Only the components that appear before [the] last large

break should be retained" (pg. 24). The Scree plot in Figure 3 identifies large breaks between components 1 and 2, and 2 and 3. The breaks between components 3 through 24 are relatively small. Therefore, it appears from analysis of the Scree plot in Figure 3 that only 2 components should be retained.

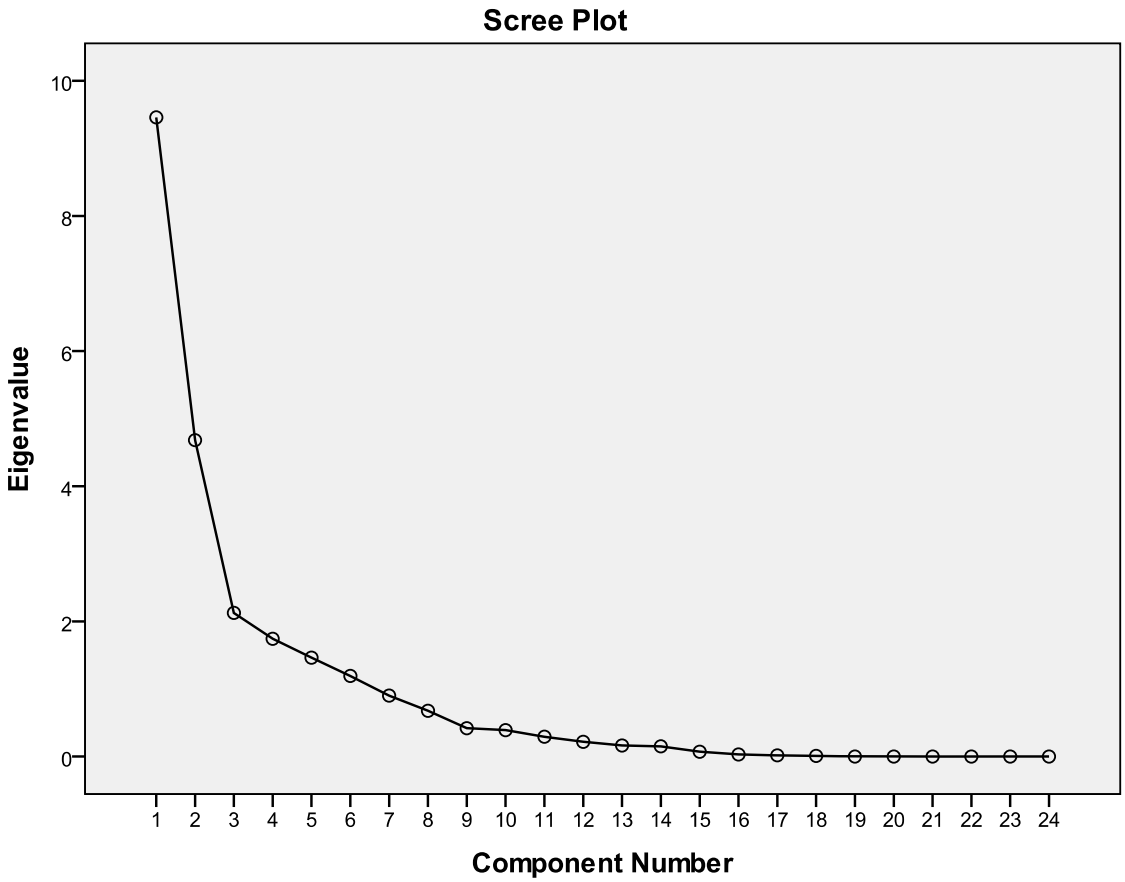

Figure 3. Scree Plot for Coach Efficacy Items.

Ultimately, the interpretability criteria is the most important criteria for addressing the issue of 'number-of-components' (Hatcher, 1994). According to the interpretability criteria, each component must consist of at least 3 or more variables, and these variables must prove to be conceptually associated with each other. Therefore, only 3 interpretable components were retained: Mathematics Content and Mathematics-Specific Pedagogy; Student Centered and General Pedagogy; and Interpersonal and Communication. Consequently, a final Varimax rotated principal component analysis was run, which extracted 3 components. Eigenvalues and percents of variance for the final principal component analysis can be found in Table 5. The rotated component matrix for the final principal component analysis can be found in Table 6.

Table 5

SPSS Output: Principal Component Analysis Table of Eigenvalues and Percent of Variance when extracting 3 components

Total Variance Explained

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	9.458	39.410	39.410	6.556	27.317	27.317
2	4.682	19.507	58.917	5.060	21.083	48.400
3	2.125	8.856	67.773	4.650	19.373	67.773
4	1.742	7.260	75.033			
5	1.463	6.095	81.128			
6	1.192	4.968	86.096			
7	.901	3.755	89.850			
8	.677	2.819	92.669			
9	.419	1.747	94.416			
10	.390	1.626	96.042			
11	.292	1.218	97.260			
12	.217	.904	98.165			
13	.163	.681	98.846			
14	.150	.624	99.470			
15	.071	.296	99.765			
16	.030	.125	99.890			
17	.017	.070	99.960			
18	.009	.040	100.000			
19	5.585E-16	2.327E-15	100.000			
20	3.890E-16	1.621E-15	100.000			
21	8.066E-17	3.361E-16	100.000			
22	-1.136E-16	-4.732E-16	100.000			
23	-2.216E-16	-9.234E-16	100.000			
24	-8.197E-16	-3.415E-15	100.000			

Extraction Method: Principal Component Analysis.

Table 6

SPSS Output: Principal Component Analysis Rotated Component Matrix

Rotated Component Matrix[a]

	Component		
	1	2	3
Q6	.897		
Q8	.874		
Q12	.872		
Q13	.852		
Q11	.835		
Q16	.813		
Q15	.740		
Q9	.691		
Q21		.914	
Q22		.901	
Q1		.723	
Q23		.717	
Q20		.694	
Q7		.618	
Q14	.570	.591	
Q19			.807
Q4			.800
Q24			.702
Q3			.688
Q2			.681
Q18			.666
Q17		.577	.615
Q10	.514		.531
Q5		.435	.441

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 5 iterations.

Reliability and Validity

Previous research studies utilized the instructional coaching efficacy items from the Coaching Efficacy Questionnaire and have reported high reliabilities for the clusters

Mathematics Content and Mathematics Specific Pedagogy (Cronbach's α=.935); Student Centered (General) Pedagogy Coaching (Cronbach's α=.932); and Building Coaching Relationships (Cronbach's α=.822) (Yopp, Burroughs, Sutton, Swackhamer, & Greenwood, 2010). Despite previous factor analyses, a principal component analysis was conducted with the data collected from this study. Three factors emerged.
Similar to previous component factor analyses, high reliabilities were reported for the clusters Mathematics Content and Mathematics-Specific Pedagogy Efficacy (Cronbach's α=.938); Student-Centered and General Pedagogy Efficacy (Cronbach's α=.895); and Interpersonal and Communication Coaching Efficacy (Cronbach's α=.871).

Additionally, previous studies have utilized the items from the Coaching Effectiveness Questionnaire and have reported high reliabilities for the clusters: Topics Discussed (Behavior) (Cronbach's α=.973); Coaching Relationships (Cronbach's α=.953); and Impact of Coaching (Cronbach's α=.967) (Yopp et al., 2010). Similar to previous component factor analyses, high reliabilities were reported for the clusters instructional coach behavior (Cronbach's α=.987), instructional coach impact (Cronbach's α=.986), and teacher satisfaction with their instructional coach (Cronbach's α=.950).

To ensure the reliability and validity of data reported, appropriate assessment of the relationship between self-efficacy and performance requires that both measures are aligned (Bandura, 1997; Moritz, Feltz, Mack, & Fahrbach, 2001). This approach allows for the analysis of the degree of congruence between self-efficacy and performance at the level of individual tasks (Bandura, 1997). As displayed, the instruments used to assess instructional coaching efficacy and instructional coach outcomes are clearly matched.

Specifically, the coaching efficacy questionnaire consists of three dimensions of efficacy: Mathematics Content and Mathematics Specific Pedagogy Efficacy, Student-Centered and General Pedagogy Efficacy, and Interpersonal and Communication Coaching Efficacy. In matching each of these efficacy domains to behavior, the Coach Effectiveness Questionnaire consisted of behaviors specifically aligned with each domain of efficacy. Specifically with Mathematics Content and Mathematics Specific Pedagogy and Student-Centered and General Pedagogy, efficacy dimensions were aligned with most items used to assess instructional coach behaviors. Furthermore, items used to assess instructional coach behaviors were aligned with most items used to assess instructional coach impact.

In addition to ensuring alignment, measures of efficacy and performance should include specific domains of functioning as opposed to global expectations of performance (Bandura, 1977, 1986, 1997). In instances where measures consisted of one-item questions, as opposed to domains, reliability and validity issues emerged (Feltz & Chase, 1998 as cited in Feltz & Lirgg, 2001). In an attempt not to violate the aforementioned premises, both instruments consisted of clusters of more than 6 items each.

Beyond the structure of each instrument, Bandura (1997) warned against time lapses between assessment of self-efficacy and performance. During a time lapse, coach efficacy may be altered by an intervening experience. If performances were assessed after a change in coach efficacy, which occurred during a time lapse, results would not be valid representations of the true relationships between efficacy and performance. Therefore, to prevent this issue from occurring, behavior assessments were conducted within a week time of receiving coach efficacy responses.

Furthermore, a point biserial correlation was run for the data set and there was no significant change in the alpha value when any of the sub-items were deleted.

Test of Assumptions

Analysis of statistical tests is enhanced when assumptions of normality, linearity, and homoscedasticity are met in multivariate procedures (Tabachnick & Fidell, 2007; Hair, Anderson, Tatham, and Black, 1998). Both graphical and numerical methods were used to assess the aforementioned assumptions.

Normality. When a canonical correlation is used descriptively, there is no requirement for variables to be normally distributed. However, normality standardizes distributions to allow for the maximizing of correlation among the variables, and is required for making inferences related to the significance testing of individual canonical functions (Hair, Anderson, Tatham, and Black, 1998). Therefore, normality is desirable despite a lack of requirement.

In determining normality, the distribution of variable means was assessed. Analysis of variable means is acceptable in instances in which data is grouped (Tabachnick & Fidell, 2007). For purposes of this study, normality was analyzed from a grouped data approach because teacher perceptions of instructional coach behavior, instructional coach impact, and their satisfaction was dependent upon experiences with individual instructional coaches. Consequently, personal coach characteristics for each of the instructional coaches that participated in this study were transformed into dummy variables. In analyzing the distribution of variable means, skewness and kurtosis were found to be within an acceptable range. Furthermore, the null hypothesis of normality was accepted for each continuous variable-see Table 7.

Table 7

SPSS Output: Normality Tests

Tests of Normality

Dependent Variables	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Instructional Coach Behavior	.124	16	.200*	.925	16	.206
Instructional Coach Impact	.105	16	.200*	.942	16	.376
Teacher Satisfaction	.108	16	.200*	.956	16	.595
Interpersonal & Communication Coaching Efficacy	.132	16	.200*	.946	16	.435
Math Content & Math Pedagogy Coaching Efficacy	.111	16	.200*	.953	16	.543
Student-Centered & General Pedagogy Coaching Efficacy	.115	16	.200*	.954	16	.561

a. Lilliefors Significance Correction

*. This is a lower bound of the true significance.

Normal probability plots were also used to determine the normality of the distribution of variable means for both sets of metric variables. According to Tabachnick & Fidell (2007), the distribution is considered normal if "…the points for the cases [on the normal probability plot] fall along the diagonal running from lower left to upper right, with some minor deviations due to random processes." (pg. 81) Therefore, based upon Table 7, normality is assumed for all continuous variables.

Linearity. The relationship between two variates must be linear in order for a canonical correlation to capture its' relationships. According to Tabachnick & Fidell (2007), "…[i]f both variables are normally distributed and linearly related, the scatterplot is oval-shaped." (pg. 83) Therefore, examination of bivariate scatterplots support the assumption of linearity.

Homoscedasticity. Homoscedasticity is known as homogeneity of variance, when data is grouped (Tabachnick & Fidell, 2007). In assessing the assumption of homogeneity of variance, Levene's formal test of homogeneity of variance will be performed. The null hypothesis for the test of homogeneity of variance states that the variance of the dependent variable is equal across groups defined by the independent variable. Dependent variables instructional coach behavior and instructional coach impact did not violate the assumption of homogeneity of variance; however, the dependent variable teacher satisfaction with instructional coach did violate assumption of homogeneity of variance-see Table 8. Although the dependent variable teacher satisfaction with instructional coach violates the assumption of homogeneity of variance, this variable will not be transformed; however, a more stringent α level (α=.025) will be used.

Table 8

SPSS Output: Homogeneity Test Across Instructional Coach Groups)

Test of Homogeneity of Variances

	Levene Statistic	df1	df2	Sig.
Total Behavior	.746	15	124	.733
Total Impact	1.158	15	124	.314
Total Satisfaction	2.172	15	124	.011

CHAPTER 4

Results

This chapter presents the major findings of this correlational study and includes a description of the participants and statistical analyses of the instructional coaches' responses to the Coach Efficacy Questionnaire and elementary teachers' responses to the Coach Effectiveness Questionnaire. Specifically, this study sought to identify whether meaningful association exists between the sources and the dimensions of instructional coaching efficacy.

Research Question Analysis

This study explored two research questions that addressed the association between sources of instructional coaching efficacy and dimensions of Instructional coaching efficacy, and instructional coach characteristics and instructional coach outcomes.

Research Question One

To what extent are sources of instructional coaching efficacy associated with dimensions of instructional coaching efficacy? Research question one was analyzed using correlation analysis. All correlations can be found in Table 9.

Sources and Dimensions of Instructional Coaching Efficacy. No meaningful associations were found between instructional coaches' perception of teacher ability and Mathematics Content & Mathematics Pedagogy coaching efficacy, Student-Centered & General Pedagogy coaching efficacy, and Interpersonal & Communication coaching efficacy. No meaningful associations were found between instructional coaches' perception of school support and Mathematics Content & Mathematics Pedagogy coaching efficacy, Student-Centered & General Pedagogy coaching efficacy, and

Interpersonal & Communication coaching efficacy. No meaningful associations were found between instructional coaches' years coaching experience and Mathematics Content & Mathematics Pedagogy coaching efficacy, Student-Centered & General Pedagogy coaching efficacy, and Interpersonal & Communication coaching efficacy. No meaningful associations were found between instructional coaches' years experience teaching mathematics and Mathematics Content & Mathematics Pedagogy coaching efficacy, Student-Centered & General Pedagogy coaching efficacy, and Interpersonal & Communication coaching efficacy. No meaningful associations were found between instructional coaches' degree level and Mathematics Content & Mathematics Pedagogy coaching efficacy, Student-Centered & General Pedagogy coaching efficacy, and Interpersonal & Communication coaching efficacy. However, there was a strong positive relationship between Degree Major (Math) and Mathematics Content & Mathematics Pedagogy coaching efficacy (ME): $r(19) = .534$, $p = .018$. The r^2 statistic showed that approximately 29% of the variance in Mathematics Content & Mathematics Pedagogy coaching efficacy is associated with having a degree in mathematics.

Table 9

Correlations among Sources (Teacher Ability, School Support, Coaching Experience, Math Teaching Experience, Highest Degree Earned, & Degree Major) and Dimensions (ME, SE, IE, and TCE) of Instructional Coaching Efficacy

		Math Content & Math-Specific Pedagogy	Student Centered & General Pedagogy	Interpersonal & Communication
Coach Perceived	Pearson Correlation	.155	-.234	-.093
Teacher Ability	Sig. (2-tailed)	.527	.335	.706
	N	19	19	19
Coach Perceived	Pearson Correlation	-.168	-.225	-.028
School Support	Sig. (2-tailed)	.492	.354	.910
	N	19	19	19
Coach: Math	Pearson Correlation	.287	.021	-.252
Teaching Experience	Sig. (2-tailed)	.233	.931	.298
(Yrs)	N	19	19	19
Coach: Math	Pearson Correlation	.092	.275	.159
Coaching Experience	Sig. (2-tailed)	.707	.255	.516
(Yrs)	N	19	19	19
Coach: Degree Level	Pearson Correlation	-.013	.009	.022
	Sig. (2-tailed)	.959	.970	.930
	N	19	19	19
Coach: Degree: Math	Pearson Correlation	.534*	.435	.215
Major	Sig. (2-tailed)	.018	.063	.376
(0=No, 1=Yes)	N	19	19	19

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Research Question Two

To what extent are dimensions of instructional coaching efficacy associated with instructional coach outcomes? Research question two was analyzed using canonical correlation analysis. Before analysis, the criterion variables (instructional coach behavior, instructional coach impact, and teacher satisfaction with their instructional coach) were screened for normality, linearity, missing data, and outliers. Skewness, kurtosis, and outlier effects were found to be within an acceptable range. Furthermore, numerical and

graphical methods rejected the null hypothesis of normality. However, as long as the non-normality of a distribution does not decrease the correlation, Hair and colleagues (1998) report that canonical correlation analysis can accommodate any metric variable without the strict assumption of normality (Hair, Anderson, Tatham, and Black, 1998). Nevertheless, "multivariate normality is required for the statistical inference test of the significance of each canonical function." (Hair et al., p. 15) Therefore, statistical significance test for each canonical function should not be the sole factor in determining which canonical functions should be analyzed. Assumptions regarding within-set multicollinearity were met, as well as linearity-see.

Furthermore, in a canonical correlation analysis, a sufficient number of observations per variable are necessary. This study consisted of a set of variables that made up a predictor canonical variate and a set of variables that made up a criterion canonical variate, for each function. The predictor canonical variate consisted of 3 variables: interpersonal and communication coaching efficacy (IE), mathematics content and mathematics-pedagogy coaching efficacy (ME), student-centered & general pedagogy coaching efficacy (SE). The criterion variable set included three variables: instructional coach behavior, instructional coach impact, and teacher satisfaction with their instructional coach. Consequently, each set consisted of no more than 3 variables. Because a very small or large sample size can have a significant impact on statistical significance, researchers encourage at least 10 observations per variable to avoid "overfitting" the data (Hair et al., 1998). According to this theory, a minimum sample size of 30 was needed. The sample size achieved in this study was 140, exceeding the minimum requirement.

Dimensions and Instructional Coach Outcomes. A canonical correlation analysis was conducted to assess the extent of association between the set of dimensions of instructional coaching efficacy variables and the set of instructional coach outcome variables. Each set was composed of three variables. The set that represented the predictor variate (dimensions of instructional coaching efficacy) was made up of 3 independent variables: Interpersonal & Communication coaching efficacy, Student-Centered & General Pedagogy coaching efficacy, Mathematics Content & Mathematics Pedagogy coaching efficacy. The set that represented the criterion variate (instructional coach outcomes) was made up of 3 dependent variables: Instructional Coach Behavior, Instructional Coach Impact, and Teacher satisfaction with instructional coach. The analysis yielded three functions with squared canonical correlations (R_c^2) of .195, .055, and .0004 for each successive function. Collectively, the full model across all functions was statistically significant using the Wilks' λ=.761 criterion, $F(9, 326.27) = 4.309$, $p < .001$. Wilks' λ represents the variance unexplained by the model; therefore, 1-λ yields the full model effect size in an r^2 metric. Thus, for the set of three canonical functions, the r^2 type effect size was approximately .239, which indicates that the full model explained about 24%, of the variance shared between the variable sets.

In order to interpret the extent to which dimensions of instructional coaching efficacy are associated with instructional coach outcomes, a deeper analysis of the individual canonical functions was necessary. Due to both sets consisting of 3 variables, only 3 functions emerged. Prior to interpretation, various tests were conducted to determine which of the three canonical functions would be interpreted. According to Hair, Anderson, Tatham, and Black (1998), it is important that the level of statistical

significance, magnitude of canonical relationship, and redundancy measure for the percentage of variance accounted for between the two sets, are simultaneously analyzed when determining which function to interpret. Analysis of all 3 criteria is important; in that, a function could potentially be statistically significant but account for too small of a variance to have practical significance.

As noted, the full model (Functions 1 to 3) was statistically significant. Functions 2 to 3 was not statistically significant, $F(4, 270) = 1.936$, $p = .105$. Function 3 (which was the only function that was tested in isolation) also did not explain a statistically significant amount of shared variance between the variable sets, $F(1, 136) = 0.055$, $p = .814$. In regards to the magnitude of each canonical relationship, the first canonical correlation was 0.441 (19% overlapping variance), the second canonical correlation was 0.234 (5% overlapping variance), and the third canonical correlation was 0.020 (<1% overlapping variance). Moreover, the redundancy indexes were also analyzed. A redundancy index provides a summary measure of the ability of a variate to explain the variance in the variables that make up the other variate. Although both sets have redundancy index, this study is concerned with explaining the ability of dimensions of instructional coaching efficacy (predictor variate) to predict instructional coach outcomes (criterion variate) and, therefore, will only report the redundancy index that explains the variance extracted from the dependent variable set by the independent variate ($rd_{x \rightarrow y}$). The redundancy indexes for functions 1, 2, and 3 were .13, .01, and <.01, respectively. According to Pedhazur (as cited in Feltz et al., 1999), a redundancy index of 10% or higher is considered meaningful. Based upon assessment of these criteria, only canonical correlations for function 1 will be used for interpretation of the relationship between

dimensions of instructional coaching efficacy and instructional coach outcomes. Data on the three pairs of canonical variates appear in Table 10. For detailed SPSS output refer to Appendix E.

Table 10

Standardized canonical coefficients and structure coefficients for all variables across functions1, 2, and 3

	Function 1			Function 2			Function 3			
Variable	*Coef*	r_s	r_s^2 *(%)*	*Coef*	r_s	r_s^2 *(%)*	*Coef*	r_s	r_s^2 *(%)*	h^2*(%)*
Dependent Variate										
Instructional Coach Behavior	1.86	.95	91.02	-.40	.05	0.24	-2.56	.30	8.74	100.00
Instructional Coach Impact	-.89	.81	65.85	-1.05	.05	0.21	3.03	.58	33.94	100.00
Teacher Satisfaction	-.09	.69	47.77	1.79	.60	35.55	-.02	.41	16.67	100.00
Proportion of Variance			**68.21**			**12.00**			**19.79**	**100.00**
Redundancy Index			**13.29**			**0.66**			**0.01**	**13.96**
Independent Variate (Covariate)										
Interpersonal Communication	.93	.98	96.44	-.20	-.18	3.34	1.08	.05	0.22	100.00
Math Content & Pedagogy	.20	.57	32.82	.90	.74	54.71	-.62	-.35	12.48	100.00
Student & General Pedagogy	-.04	.58	33.88	-.54	-.54	29.57	-1.21	-.60	36.55	100.00
Proportion of Variance			**54.38**			**29.20**			**16.42**	**100.00**
Redundancy Index			**2.97**			**1.59**			**0.01**	**4.57**
Canonical correlation (R_c)		**.442**			**.234**			**.020**		
Percent of Variance (R_c^2)			**19.49**			**5.46**			**0.04**	**24.99**

Note. Structure coefficients (r_s) greater than │.45│are underlined. Communality coefficients (h^2) greater than 45% are underlined. Coef = standardized canonical function coefficient; r_s= structure coefficient; r_s^2 = squared structure coefficient; h^2 = communality coefficient.

Given that the canonical relationships are statistically significant and the magnitudes of the canonical roots and the redundancy index are acceptable, substantive interpretations of the results are still needed (Hair et al., 1998). However, although mathematically elegant, canonical solutions are sometimes hard to interpret (Tabachnick & Fidell, 2007). Making such interpretations involve examining each significant canonical function and determining which original variables in each set are significant contributors to the canonical variates.

In examining function 1, 2 latent variates were derived for each set of variables. The independent variate extracted 54% variance from the independent variables and the dependent variate extracted 68% variance from the dependent variables. In assigning meaning to each of these latent variates, the with-in variable-to-variate correlation was assessed. According to Comrey and Lee (as cited in Tabachnick & Fidell, 2007), loadings in excess of .71 (50% overlapping variance) are excellent, .63 (40% overlapping) very good, .55 (30% overlapping variance) good, .45 (20% overlapping variance) fair, and .32 (10% overlapping variance) poor. Therefore, loadings greater than .45 (20% overlapping variance) were used in determining the variables that significantly contributed to the derivation of each variate.

All three variables in the predictor variate demonstrated a meaningful contribution to the set's canonical variate: interpersonal and communication (IE) coaching efficacy (r_s = .982), mathematics content & mathematics pedagogy (ME) coaching efficacy (r_s = .573), and student-centered and general pedagogy (SE) coaching efficacy (r_s = .582). All 3 variables were directly related to each other. Correlations between the variables in this set (dimensions of instructional coaching efficacy) and the canonical variate suggest that

all of the dimensions of instructional coaching efficacy were important contributors to the independent variate. In determining which original variables in the set representing instructional coach outcomes were meaningful contributors to the set's canonical variate, all the variables were meaningfully related to the set's canonical variate: instructional coach behavior (r_s = .954), instructional coach impact (r_s = .811), and teacher satisfaction with their instructional coach (r_s = .691). The variables' structure coefficients (r_s) had the same sign, indicating that they were all directly related to each other. Correlations between the variables in this set (instructional coach outcomes) and the canonical variate suggest that all of the instructional coach outcomes were important contributors to the dependent variate.

With meaning assigned to each variate, the canonical correlation analysis implies that an instructional coach with high levels of efficacy in interpersonal & communication coaching, mathematics content and mathematics-specific pedagogy, and student-centered and general pedagogy coaching is likely to implement instructional coach behaviors that are characteristic of successful instructional coaches at a higher level, thus having a greater impact on teaching practice, and foster higher levels of teacher satisfaction. This relationship is diagramed in Figure 3.

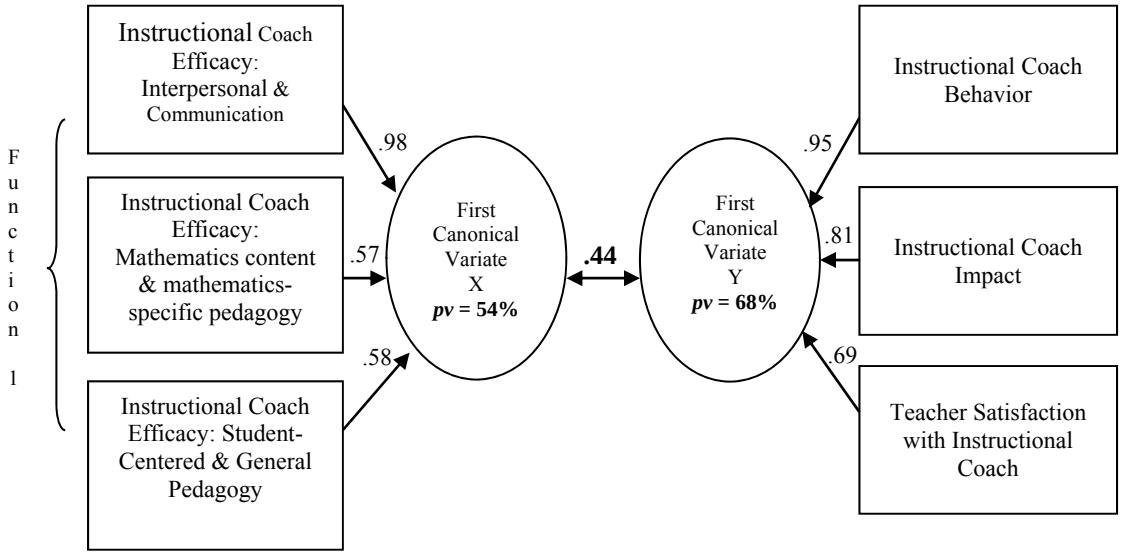

Figure 4 . Function 1 Canonical correlation Analysis (excluding proxy variables coach). *Note.* Figure 4 is adapted from Tabachnick & Fidell (2007) canonical correlation analysis model.

Although canonical correlation analysis supports the theoretical framework Instructional Coaching Efficacy, by confirming a significant association between a set of dimensions of instructional coaching efficacy and a set of instructional coach outcomes, it does not specifically identify the extent of this association. To more specifically explain the observed relationship between dimensions of instructional coaching efficacy and instructional coach outcomes, a multivariate multiple regression analysis was conducted to determine the predictive strength of each of the dimensions of instructional coaching efficacy on instructional coach outcomes.

Hypothesis 1 predicted that interpersonal & communication (IE) coaching efficacy, mathematics content and mathematics-specific pedagogy (ME), and student-centered and general pedagogy (SE) would be significant predictors of instructional coach behavior. Results of the multiple regression analysis for instructional coach behavior indicated that the overall regression was significant, $F(3, 139) = 9.786$, $p < .01$,

yielding a small effect size (R = .421, R^2 = .178, adjusted R^2 = .159). The hypothesis was partially supported. Only interpersonal & communication (IE) coaching efficacy was a significant predictor of instructional coach behavior (β =.395, t = 3.534, p < .01).

Table 11

SPSS Output: Multiple Regression Analysis (Instructional Coach Behavior)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.421[a]	.178	.159	1.1929902779

a. Predictors: (Constant), Student-Centered & General Pedagogy, Mathematics Content & Mathematics-Specific Pedagogy, Interpersonal & Communication

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	41.784	3	13.928	9.786	.000
	Residual	193.559	136	1.423		
	Total	235.343	139			

a. Predictors: (Constant), Interpersonal & Communication, Mathematics Content & Mathematics-Specific Pedagogy, and Student-Centered & General Pedagogy

b. Dependent Variable: Instructional Coach Behavior

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-1.777	1.100		-1.615	.109
	Interpersonal & Communication	1.123	.318	.395	3.535	.001
	Math Content & Math-Specific Pedagogy	.190	.183	.090	1.039	.300
	Student-Centered & General Pedagogy	-.090	.294	-.031	-.306	.760

a. Dependent Variable: Instructional Coach Behavior

Hypothesis 2 predicted that interpersonal & communication (IE) coaching efficacy, mathematics content and mathematics-specific pedagogy (ME), and student-centered and general pedagogy (SE) would be significant predictors of instructional coach impact. Results of the multiple regression analysis for instructional coach impact indicated that the overall regression was significant, $F(3, 139) = 6.689$, $p < .01$, yielding a small effect size ($R = .359$, $R^2 = .129$, adjusted $R^2 = .109$). The hypothesis was partially supported. Only interpersonal & communication (IE) coaching efficacy was a significant predictor of instructional coach impact ($\beta = .343$, $t = 2.982$, $p < .01$).

Table 12

SPSS Output: Multiple Regression Analysis (Instructional Impact)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.359[a]	.129	.109	1.6672258163

a. Predictors: (Constant), CE_Student Centered Pedagogy, CE_Math Content & Pedagogy, CE_Interpersonal Communication

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	55.783	3	18.594	6.689	.000[a]
	Residual	378.031	136	2.780		
	Total	433.814	139			

a. Predictors: (Constant), CE_Student Centered Pedagogy, CE_Math Content & Pedagogy, CE_Interpersonal Communication

b. Dependent Variable: Total Impact

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-1.848	1.537		-1.202	.231
	CE_Interpersonal Communication	1.323	.444	.343	2.982	.003
	CE_Math Content & Pedagogy	.210	.255	.073	.822	.413
	CE_Student Centered Pedagogy	-.137	.411	-.035	-.333	.740

a. Dependent Variable: Total Impact

Hypothesis 3 predicted that interpersonal & communication (IE) coaching efficacy, mathematics content and mathematics-specific pedagogy (ME), and student-centered and general pedagogy (SE) would be significant predictors of teachers' satisfaction with their instructional coach. Results of the multiple regression analysis for teacher satisfaction with their instructional coach indicated that the overall regression was significant, $F(3, 139) = 5.751$, $p < .01$, yielding a small effect size ($R = .336$, $R^2 = .113$, adjusted $R^2 = .093$). The hypothesis was partially supported. Interpersonal & communication (IE) coaching efficacy ($\beta = .264$, $t = 2.272$, $p = .025$) and mathematics content & mathematics-specific pedagogy ($\beta = .181$, $t = 2.012$, $p = .046$) were significant predictors of teacher satisfaction with their instructional coach.

Table 13

SPSS Output: Multiple Regression Analysis (Teacher Satisfaction with Instructional Coach)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.336[a]	.113	.093	1.0773565232

a. Predictors: (Constant), CE_Student Centered Pedagogy, CE_Math Content & Pedagogy, CE_Interpersonal Communication

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	20.026	3	6.675	5.751	.001[a]
	Residual	157.855	136	1.161		
	Total	177.881	139			

a. Predictors: (Constant), CE_Student Centered Pedagogy, CE_Math Content & Pedagogy, CE_Interpersonal Communication

b. Dependent Variable: Total Satisfaction

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.034	.993		1.041	.300
	CE_Interpersonal Communication	.651	.287	.264	2.272	.025
	CE_Math Content & Pedagogy	.332	.165	.181	2.012	.046
	CE_Student Centered Pedagogy	-.245	.265	-.099	-.923	.358

a. Dependent Variable: Total Satisfaction

Individual instructional coach differences. "Much of what goes on in education occurs within some group context." (Burstein, 1980, pg. 158) The teachers within this study taught within schools. Each of these schools employed individual instructional coaches who possessed individual personality traits and characteristics. Researchers have long found that personality characteristics are significant factors in determining leaders' outcomes (Crust & Lawrence, 2006). Moreover, antecedents (sociocultural context, organizational climate, and personal characteristics of a coach) indirectly influence coach' behavior (Horn, 2002). As a result, coach effectiveness is influenced by situational factors and individual differences (Horn, 2002 as cited in Myers, Vargas-Tonsing, Feltz, 2005). Therefore, for the sake of this study, coach 1', coach 2', etc. was used as a proxy variable to represent the contextual factors and individual differences of the 16 instructional coaches. Furthermore, 15 dummy coded variables were created for the 16 instructional coaches.

In order to determine the role that these instructional coach differences played in the variance of instructional coach outcomes, a canonical correlation analysis was conducted, to assess the extent of association between the set of dimensions of instructional coaching efficacy variables and the set of instructional coach outcome variables. The set that represented the predictor variate (dimensions of instructional coaching efficacy) was made up of 18 variables: Interpersonal & Communication coaching efficacy, Student-Centered & General Pedagogy coaching efficacy, Mathematics Content & Mathematics Pedagogy coaching efficacy, and 15 dummy coded coach variables. The set that represented the criterion variate (instructional coach outcomes) was made up of 3 dependent variables: instructional coach behavior,

instructional coach impact, and teacher satisfaction with their instructional coach. The analysis yielded three functions with squared canonical correlations (R_c^2) of .313, .212, and .129 for each successive function. Collectively, the full model across all functions was statistically significant using the Wilks' λ=.471 criterion, $F(45, 363.21) = 2.326$, $p < .001$. Wilks' λ represents the variance unexplained by the model; therefore, 1-λ yields the full model effect size in an r^2 metric. Thus, for the set of three canonical functions, the r^2 type effect size was .654, which indicates that the full model explained a substantial portion, about 65%, of the variance shared between the variable sets.

The initial canonical correlation analysis (which did not include the dummy variables for instructional coach) accounted for approximately 24% of the variance in instructional coach outcomes. The subsequent canonical correlation analysis, which included dummy variables that represented individual instructional coaches, reported that the variables in the predictor variate (dimensions of instructional coach efficacy) accounted for approximately 65% of the variance in the criterion variate (instructional coach outcomes). This infers that the proxy variable that represented instructional coaches was responsible for the significant increase (41%) in the variance of the set that represented instructional coach outcome variables. Therefore, individual characteristics of instructional coaches and their context play a significant role in instructional coach outcomes. Standardized canonical function coefficients, structure coefficients, squared structure coefficients, redundancy indexes, and proportion of variance for this canonical correlation analysis appear in Table 14.

Table 14

Standardized canonical coefficients and structure coefficients for all variables across functions1, 2, and 3 (including proxy variables for individual instructional coach)

	Function 1			Function 2			Function 3			
Variable	*Coef*	r_s	r_s^2 *(%)*	*Coef*	r_s	r_s^2 *(%)*	*Coef*	r_s	r_s^2 *(%)*	h^2*(%)*
Dependent Variate										
Instructional Coach Behavior	-2.26	-.84	71.13	-.91	.49	24.01	2.07	-.22	4.87	100.00
Instructional Coach Impact	.97	-.67	44.57	.25	.57	32.84	-3.17	-.48	22.58	100.00
Teacher Satisfaction	.60	-.42	17.47	1.44	.91	82.20	0.89	-.06	0.33	100.00
Proportion of Variance			**44.39**			**46.35**			**9.26**	**100.00**
Redundancy Index			**13.91**			**9.83**			**1.19**	**24.94**
Independent Variate (Covariate)										
Interpersonal Communication	-2.92	-.75	56.79	.54	.23	5.44	.07	-.04	0.18	62.41
Math Content & Pedagogy	1.38	-.34	11.42	-1.59	.48	23.23	.58	.26	6.83	41.49
Student & General Pedagogy	1.38	-.50	25.34	-.36	-.06	0.32	.18	-.13	1.73	27.38
Coach 1’	-.66	.72	51.23	-1.25	-.45	20.65	.57	-.01	0.02	71.89
Coach 2’	-.50	-.15	2.31	.22	.06	0.36	-.12	-.02	0.05	2.73
Coach 3 ‘	.80	-.01	0.01	-1.35	-.19	3.62	.24	-.16	2.60	6.23
Coach 4 ‘	-.73	.15	2.30	.37	.11	1.18	-.17	-.11	1.12	4.61
Coach 5’	-.10	-.33	11.06	-1.00	-.19	3.48	-.08	-.44	19.08	33.62
Coach 6 ‘	-.55	-.16	2.54	-.13	.20	4.06	.71	.55	30.12	36.72
Coach 7 ‘	-.91	-.02	0.05	-.44	-.05	0.27	.10	-.15	2.24	2.56
Coach 8 ‘	-.26	-.08	0.66	-.84	-.38	14.72	.41	.17	2.77	18.15
Coach 9 ‘	-.77	-.30	8.97	.27	.05	0.28	-.12	.01	0.02	9.27
Coach 10 ‘	-.14	.22	5.01	.16	.27	7.46	.59	.53	28.30	40.77
Coach 11 ‘	-.03	-.19	3.77	-.62	-.23	5.46	.42	.25	6.37	15.60
Coach 12 ‘	-.89	-.12	1.53	-.25	-.08	0.62	.15	.02	0.05	2.20
Coach 13 ‘	.00	-.27	7.29	.00	.33	10.89	.00	-.11	1.21	19.39
Coach 14 ‘	.00	.37	13.69	.00	.59	34.81	.00	-.33	10.89	59.39
Coach 15 ‘	.00	-.03	0.09	.00	.12	1.44	.00	-.12	1.44	2.97
Proportion of Variance			**12.20**			**6.08**			**6.77**	**25.41**
Redundancy Index			**2.59**			**1.29**			**0.82**	**4.86**
Canonical correlation (R_c)		**.560**			**.461**			**.359**		
Percent of Variance (R_c^2)			**31.36**			**21.25**			**12.88**	**65.49**

Note. Structure coefficients (r_s) greater than │.45│ are underlined. Communality coefficients (h^2) greater than 45% are underlined. Coef = standardized canonical function coefficient; r_s= structure coefficient; r_s^2 = squared structure coefficient; h^2 = communality coefficient. Coach 13’ through Coach 15’ were

To ensure the stability of the findings of this study, multiple canonical correlations were estimated after the removal of one dependent variable at a time. Assessment of this approach to sensitivity testing showed that no significant differences occurred in the canonical relationships originally found. Moreover, results from this study were generally supportive of the theoretically expected relationships between instructional coaching efficacy and instructional coach outcomes. However, the need exists for further exploration of personal qualities that were characteristic of coach 1 and the possible reasoning behind why they were negatively related to instructional coach outcomes, which was beyond the scope of this study.

CHAPTER 5

Discussion

The two primary purposes of this study were to explore the association between sources of instructional coaching efficacy and dimensions of instructional coaching efficacy. Findings partially support previous research by demonstrating a relationship between instructional coaches' educational background in mathematics (source of information) and Mathematics Content and Mathematics-Specific Pedagogy (efficacy). Moreover, findings from this study partially support previous research by confirming the overall significant effect of instructional coach characteristics on instructional coach outcomes. Findings extend previous research by identifying instructional coach characteristics that are significantly related to specific instructional coach outcomes.

Relationship between Sources & Dimensions of Instructional Coaching Efficacy

Perceived Teacher Ability. Despite previous efficacy studies that accentuate the significant relationship between perceived ability of students and teaching efficacy, and perceived skill of athlete and coaching efficacy, no meaningful association between perceived teacher ability and instructional coaching efficacy was found. This lack of significant association between perceived teacher ability and dimensions of instructional coaching efficacy may likely be due to the influence of context factors. As recommended by Guskey & Passaro (1994), researchers should "…take care to consider a variety of explanations, both complex and simple, in attempts to interpret result" (p. 641). Therefore, in trying to understand the dynamics surrounding these contrary findings, various context factors are examined in the subsequent paragraph.

The perceived skill of an athlete is a significant source of information that

influences coaching efficacy (Feltz et al., 1999). Particularly, a coach's appraisal of their ability to affect the performance of their players is influenced by the 'outcomes' of previous experiences. These outcomes are measured up against 'outcome expectations', which are performance markers in determining success and failure (Bandura, 1997). In the context of both teaching and sports coaching, key performance indicators (outcome expectations) exist. Particularly, the success or failure of a teacher is dependent on their students' achievement on various norm-referenced state and or national assessments, student academic growth on state assessments, classroom observations of instruction, and other established performance measures. The success of a sports coach is dependent on their team's winning average, league ranking, whether the team makes it to the playoffs or championship, as well as other performance measures. Furthermore, grades such as A, B, C, D, and F, are outcome expectations, or performance measures, that assist individuals in determining whether they were successful in a particular subject or academic task. Without established outcome expectancies, individuals may not be able to accurately assess their performance or, as a result, their efficacy.

According to Kowal & Steiner (2007), well-defined research based performance markers for evaluating instructional coach effectiveness is practically nonexistent. If instructional coaches do not have concrete outcome expectations to use in appraising their experiences as successes or failures, then they may believe that their efforts to work with a particular skill/level of teacher were successful when in all actuality they were ineffective. Such inaccurate judgments potentially result in individuals who overrate their efficacy because they themselves are unsure of their true capacity to produce desired results. If instructional coaches are unable to assess their efficacy beliefs properly, due to

the absence of outcome expectations, then the relationship between perceived teacher ability and instructional coaching efficacy may not be as apparent in the context of this study as it may have been in prior studies in which descriptive performance measures were set in place. Therefore, the absence of performance markers (outcome expectations) in the context of instructional coaching may explain the lack of meaningful association observed between perceived teacher ability and instructional coaching efficacy.

Furthermore, statistically significant relationships between perceived teacher ability and instructional coaching efficacy may not have been found due to the limited sample of instructional coaches (n=19). Given a larger sample size, the small negative relationship that was noted between perceived teacher ability and the dimension Student-Centered and General Pedagogy (r = -.234) may have reached statistical significance.

Perceived School Support. Unlike previous research findings that report positive relationships between support and coaching efficacy (Feltz et al., 1999), no statistically significant relationships were found between an instructional coach's perception of support received, as it is related to mathematics coaching, and any of the three dimensions of instructional coaching efficacy. Again, small sample size may be a significant determinant in these insignificant findings or other explanations may exist.

What if sample size is truly the reason for lack of statistical significance in the small negative relationship noted between instructional coaches' perception of school support and Mathematics Content and Mathematics-Specific Pedagogy coaching efficacy (r = -.168) and Student-Centered and General Pedagogy coaching efficacy (r = -.225)? What might explain the small but 'negative' relationship between perceived support and dimensions of coaching efficacy, which contradicts previous studies that report a

‘positive’ relationship (Feltz et al., 1999; Vargas-Tonsing, Warners, & Feltz, 2003)? In trying to identify potential explanations for the small negative relationship between perceived support and instructional coaching efficacy, it appears that ‘support’ may be viewed negatively in the context of instructional coaching. Specifically, instructional coaches may view support as meaning that they are deficient in a skill. In such instances, instructional coaches may perceive receiving a significant amount of support as meaning that they are deficient and in need of assistance. Such interpretations would result in the negative relationships that were observed in this study. Conversely, instructional coaches may view a lack of support as meaning that they do not need support and are competent. Such interpretations may explain the negative association between perceived support and dimensions of instructional coaching efficacy that were observed in this study.

Education. Majoring in mathematics was the only source of information that was significantly related to dimensions of instructional coaching efficacy. Particularly, there was a moderate to large positive association between majoring in mathematics and Mathematics Content & Mathematics-Specific Pedagogy coaching efficacy (r = .534). These findings are well aligned with previous research studies, such as Hackett & Betz (1983, 1989) that report a positive relationship between mathematics education/preparation and mathematics efficacy. Although not statistically significant, a small to moderate positive relationship was noted between years teaching mathematics and Mathematics Content & Mathematics-Specific Pedagogy Coaching efficacy (r = .287). This too is in agreement with prior studies that report a positive relationship between teaching experience and self-efficacy (Prieto & Altmaier, 1994). A lack of statistical significance may have likely been due to small sample size.

Experience. In reference to instructional coaching experience, no statistically significant associations were found; however, there was a small positive relationship noted between years coaching experience and Student Centered & General Pedagogy efficacy (r = .275). This finding confirms the notion that as years of coaching experience increase, one becomes more confident in one's ability to produce desired results as it relates to student centered general pedagogical coaching of teachers. This is a new and potentially informative finding that invites further research. It is important to note that the weakness of this source of efficacy (years coaching experience) may partially be explained by a restriction of range because the majority of instructional coaches in this study possessed less than 3 years mathematics coaching experience. Although the magnitude of this relationship appears to approach a moderate positive relationship, statistical significance may not have been achieved due to limited sample size.

Surprisingly, there was a small 'negative' relationship noted between years teaching experience and Interpersonal & Communication Coaching efficacy (r = -.252). In gaining more insight into this finding, the demographics of the instructional coaches were revisited. Based upon demographic information, approximately 80% (15 out of 19) of the instructional coaches in this study had 2 or less years coaching experience (M = 1.40, SD = 0.51); and 0 to 11 years mathematics teaching experience (M = 7.53, SD = 5.44). These demographics confirm that many of the instructional coaches in this study appear to be in a 'transitioning state' from teacher to coach. The interpersonal and communication skills needed to interact with students may be very different than the interpersonal and communication skills needed to support adults. Many teachers and administrators tend to believe that having a substantial amount of teaching experience

automatically qualifies individuals for leadership positions. This study highlights the important idea that teaching experience is only 'one' of many criteria that potential candidates should possess. Moreover, this study also supports previous research findings that suggest that teachers require professional development in transitioning to their new roles as instructional coaches (Feger, Woleck, & Hickman, 2004). In the article, *How To Develop A Coaching Eye*, this notion is echoed in the quote:

> "As schools and districts explore how coaching fits into their professional development plans, they must identify the essential skills and supports needed for this complex role. Teachers, school leaders, and coaches must begin by asking: What skills are needed for coaching? What coaching strategies enhance the coach-teacher interaction? What kinds of support do coaches need? And teachers and staff developers taking on this assignment have to learn to look at what's happening in the classroom using a 'coaching eye' instead of a 'teaching eye'." Feger, Woleck, & Hickman, pg. 1).

Beyond the general notion that instructional coaches require support, this study extends this research by identifying that instructional coaches may require 'differentiated' support based upon the stage in which they are in professionally. Particularly, instructional coaches who are new to the position may require additional support in the dimension of interpersonal and communication coaching efficacy. It is important to know that, although the magnitude of this relationship appears to approach a moderate negative relationship, statistical significance was not achieved. This is likely to be due to limited sample size.

Relationship between Instructional Coaching Efficacy & Instructional Coach Outcomes

Results from this study were generally supportive of the theoretically expected relationships between instructional coaching efficacy and instructional coach outcomes. Although the initial canonical correlation analysis identified a relationship between all

three dimensions of coaching efficacy (Interpersonal & Communication Coaching efficacy, Mathematics content & mathematics-specific pedagogy, and Student-Centered & General Coaching efficacy and instructional) and all three instructional coach outcomes (instructional coach behavior, instructional coach impact, and teacher satisfaction with their instructional coach), Interpersonal & Communication coaching efficacy was the strongest predictor of instructional coach behavior, instructional coach impact, and teacher satisfaction with their coach. This finding supports existing research, which suggests that, "…interpersonal skills are a coach's most important attributes" (Kowal & Steiner, 2007, p. 4). According to Feger, Wolect, & Hickman (2004), "[m]ost important is for a coach to establish a collaborative, reflective relationship with a teacher, not to tell the teacher what to do, but serve instead as a knowledge resource and a mediator to help the teacher reflect (Feger, Wolect, & Hickman, 2004, p. 16). These findings shed light on the notion that "…*how* a coach works is just as important as *what* a coach knows" (Knight, 2004b, p. 3). Although previous research identify mathematics content and pedagogy as important characteristics that assist instructional coaches in accurately diagnosing teachers needs, such characteristics are not as valuable if instructional coaches are unable to effectively communicate observations and provide feedback on teacher practice in "…a respectful and collaborative manner" (Feger, Wolect, & Hickman, 2004, p. 16). Again, this may be a possible explanation for the findings in this study which confirm the positive relationship between Interpersonal & Communication coaching efficacy and instructional coach outcomes.

Instructional Coach Behavior. Despite previous findings that report a significant relationship between coaching efficacy and coach behavior (Feltz et al., 1999), neither

Mathematics Content & Mathematics-Specific Pedagogy Coaching efficacy nor Student-Centered & General Coaching efficacy was predictive of instructional coach behavior. This may, in part, be explained by the idea that discrepancies between efficacy beliefs and performance occur when tasks or circumstances are ambiguous (Bandura, 1997). Some instructional coaches may honestly believe that they are capable of implementing particular behaviors at a 'high level' despite a lack of clear understanding of the outcomes associated with the performance mark 'high level'. This may be the case for many instructional coaches in this study given the fact that well-defined research based performance markers for evaluating instructional coach effectiveness is practically nonexistent (Kowal & Steiner, 2007). For instance, an instructional coach may feel that they are effective in modeling lessons for teachers and as a result rate themselves as "highly confident" in their ability to model lessons. However, if the instructional coach does not have a clear understanding of what the outcomes of effective lesson modeling should be, she/he may inaccurately rate themselves on this efficacy item. Consequently, inaccurate efficacy judgments may result in a mismatch between efficacy and behavior.

Furthermore, "If performance measures are used where factors beyond one's control are partially responsible for the performance score…self-efficacy will not be as strong of a predictor of performance as performance is of self-efficacy" (Feltz, 1992, p. 10). If highly efficacious mathematics coaches are unable to implement the behaviors that were assessed in this study because of factors beyond their control, such as a lack of time to consistently meet, plan, model, and/or facilitate meaningful feedback sessions with teachers, then a mismatch between instructional coaching efficacy and teacher reports of instructional coach behavior may exist. Furthermore, if highly efficacious

mathematics instructional coaches are directed by their principals/school leaders to spend a considerable amount of time on non-math related tasks, such as lunch duty, discipline, etc., a mismatch between instructional coaching efficacy and instructional coach behavior may emerge. Though beyond the scope of this study, several teachers who participated in this study expressed their concern that their instructional coach was mandated to work with 'more critical grade levels'. This further confirms that mismatch between efficacy and behaviors may be more evident in the context of instructional coaching where factors beyond an instructional coaches' control are more prevalent.

Beyond identifying potential reasons why mathematics content & mathematics-specific pedagogy coaching efficacy and student-centered & general pedagogy coaching efficacy was not predictive of instructional coach behavior, these findings further emphasize the idea that possessing a high level of mathematics content and mathematics-specific pedagogy coaching efficacy does not necessarily guarantee that an instructional coach will implement effective coaching behaviors.

Teacher satisfaction with their instructional coach. Although Mathematics Content and Mathematics-Specific Pedagogy Coaching efficacy was not predictive of instructional coach behavior, it was predictive of teacher satisfaction with their coach. This, to some extent, implies that teachers are aware of and satisfied with their instructional coach's mathematics content and pedagogy capabilities. This supports existing research; in that, teachers are most satisfied with instructional coaches who possess a level of mathematics expertise that contributes to an increase in their mathematics knowledge (Franke et al., 2001; Penuel et al., 2007; Bruce & Ross, 2008).

While Interpersonal & Communication Coaching efficacy and Mathematics

Content and Mathematics-Specific Pedagogy Coaching efficacy were significant predictors of teacher satisfaction, no significant associations existed between Student-Centered & General Pedagogy Coaching efficacy and teacher satisfaction. In a review of several professional development studies, Richards (1998) found that "…[professional development] programs whose content focused mainly on teachers' behaviors [General Pedagogy] demonstrated smaller influences on student learning than did programs whose content focused on teachers' knowledge of the subject, on the curriculum, or on how students learn the subject" (p. 17). This holds great implication for the findings in this study because many teachers tend to rate their coach based on how helpful they are in supporting improvement of teaching skills that result in increased student achievement. If teachers do not see the value in the instructional coaching that they receive, they may view their instructional coach as ineffective. This may explain why Student-Centered & General Pedagogy Coaching efficacy was not found to be a significant predictor of teacher satisfaction.

No significant associations existed between Student-Centered & General Pedagogy coaching efficacy and teacher satisfaction with their instructional coach. In a review of several professional development studies, Kennedy (1998) found that "…[professional development] programs whose content focused mainly on teachers' behaviors [General Pedagogy] demonstrated smaller influences on student learning than did programs whose content focused on teachers' knowledge of the subject, the curriculum, or how students learn the subject" (p. 17). This holds great implication for the findings in this study because many teachers tend to rate their coach based on how helpful they are in supporting improvement of teaching skills that result in increased

student achievement. If teachers do not see the value in the instructional coaching that they receive, they may view their instructional coach as ineffective. A teacher is more likely to be satisfied with an effective instructional coach than they are with an ineffective instructional coach. This may explain why Student-Centered & General Pedagogy coaching efficacy was not found to be a significant predictor of teacher satisfaction with their instructional coach.

Limitations

Some of the limitations of this study include external validity, or the generalizability of this study. In terms of interpretation, this study was conducted in a large urban school system in the southeast region of the U.S.; therefore, instructional coaching may be significantly different in this region than in other regions of the U.S. Secondly, a sample of 19 instructional coaches is considered small and may not be representative of all mathematics instructional coaches. Additionally, instructional coaching efficacy was assessed through instructional coach self-reports and may not reflect actual instructional coach efficacy. Similarly, the answers from the respondents from the group of 144 teachers may not be representative of actual instructional coach outcomes. As a result of quantitative research design methods, using passive observational data inferences about causal relationships, if any, will be tentative. Most importantly, efficacy is a complex construct to assess; therefore, the instruments may not have been composed of the most appropriate questions for assessing efficacy judgments.

Recommendations

Based upon the interpretations presented, much research is still needed in the context of instructional coaching. More research should be focused around gaining a

better understanding of the context of instructional coaching, as it relates to instructional coach program evaluation and expected coaching outcomes. Particularly, research is needed in determining performance marks (outcome expectations) that represent different coaching levels, such as exemplary, satisfactory, unsatisfactory, needs improvement, etc. Principals, district leaders, and other supervisors of instructional coaches need these performance markers in order to make informed decisions as it relates to evaluating and supporting instructional coaching. Moreover, instructional coaches also need performance markers (outcomes) in order to self-evaluate and reflect upon their coaching practices.

In order to ensure that instructional coaches are able to implement behaviors that result in significant improvement in teacher practice, as well as student achievement, principals/supervisors of instructional coaches must attempt to control/minimize external factors that impede productive coaching behaviors. As seen in this study, situational factors and individual instructional coach differences played a significant role in the amount of variance in instructional coach outcomes. Therefore, more research is needed in exploring school level/contextual factors that may foster/impede instructional coach effectiveness. With such knowledge, school leaders may be better informed about school environments that maximize the effectiveness of their instructional coach.

Findings from this study accentuated the potential existence of a 'transitioning state' from teacher to instructional coach. Furthermore, this study pointed out a potential need for differentiated professional development for newly transitioning instructional coaches. Therefore, future studies may benefit from exploring the different professional development needs of instructional coaches that span across different stages of

instructional coaching (i.e. new coach, veteran coach, etc.).

Being that the sources, dimensions, and instructional coach outcomes included in this study were not exhaustive, future studies should also explore additional sources of instructional coaching efficacy and their influence on dimensions of instructional coaching efficacy and instructional coach outcomes. Additionally, this study did not include or assess the dimension, curriculum expertise, of instructional coaching efficacy. Future studies should explore the influence of this dimension on instructional coach outcomes.

There were several questions that could not be answered by the research design of this study. Specifically, this study could not answer questions that required explanation of specific coach characteristics, excluding dimensions of instructional coaching efficacy, that were meaningfully associated with instructional coach outcomes. Moreover, the design of this study did not assist in explaining why particular relationships between sources, dimensions, and/or instructional coach outcomes did or did not exist in the context of this study. Therefore, it is recommended that future studies involve a larger instructional coach sample size. Additionally, mixed method research designs are recommended in confirming the relationships found in this study. Findings from the recommended studies will significantly contribute to the scarce, yet growing research on instructional coaching, as well as the role that school level support plays in instructional coach effectiveness.

Conclusion

Research on instructional coaching has primarily focused on descriptive studies that address questions such as, ‘What is Instructional Coaching?’ and ‘Does Instructional

Coaching Work?' (Borman & Feger, 2006). According to Borman and Feger (2006), "…there is [only] a small set of efficacy studies on coaching available" (p. 12). Therefore, in reviewing literature related to coaching efficacy, several studies from the field of sports were analyzed. From such studies, researchers have found that coaching efficacy is significantly related to sources and outcomes of coaching efficacy (Feltz et al., 1999; Myers, Vargas-Tonsing, & Feltz, 2005; Short, Smiley, & Ross-Stewart, 2005).

The concept of Coaching Efficacy was first introduced by researchers Feltz, Chase, Moritz, and Sullivan (1999) who studied the relationship between sources of coaching efficacy and dimensions of coaching efficacy among high school coaches. The findings of their study confirmed that particular sources exert influence over various coaching efficacies, which in turn influence instructional coach outcomes. Particularly, experienced sports coaches who are successful and possess higher perceptions of their team's ability are said to be more confident in their game strategy, motivating abilities, and their instructional techniques. Furthermore, high efficacy coaches were more successful and had higher win averages than did low efficacy coaches in this study. A similar study, conducted among volunteer youth sport coaches, also found that particular sources were related to particular dimensions of coaching efficacy and coach outcomes (Feltz, Hepler, & Roman, 2009).

Despite studies that have provided evidence for the conceptual model of coaching efficacy, Feltz and colleagues (1999) recommended "…that future studies be conducted with different populations, sports, settings, and men and women" (pg. 775). They also recommended that additional sources and outcomes of coaching efficacy be examined. In addressing the need to extend research on coaching efficacy, this study was conducted in

an educational setting as opposed to a sports setting. It involved sources, dimensions, and outcomes that are specific to the context of mathematics education. This change in setting allowed for new research findings that pertain specifically to mathematics instructional coaches. Particularly, this study has provided potential answers to the following questions: *"What support systems should be in place for coaching to flourish?"*, and *"What explicit coaching frameworks exist for analyzing the components of instructional coaching their possible impacts"*. Furthermore, the items used to assess instructional coach efficacy have been validated and may be used by school districts as a measure for assessing instructional coach efficacy. The Instructional Coaching Efficacy model may also be used by future researchers to study instructional coach effectiveness.

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APPENDICES

Appendix A

SurveyMonkey - MyCollector: Message Preview Page 1 of 1

marshacecile • Sign Out •

My Surveys Address Book My Account Plans & Pricing + Create Surv

Coach Efficacy Questionnaire Edit

View Summary
Edit Recipients
Edit Messages
Change Settings
Change Restrictions

Georgia State University Edit

Email Invitation NOT CONFIGURED

Message Summary

« Back to Messages List

Message Delivery Schedule

Send a Test Message | Schedule Delivery

The message has not been scheduled for delivery yet.

Message Recipients Edit

The message currently has 0 potential recipients.

Message Preview Edit

No recipients have been defined, so we can't generate a full preview of your message.

To:

From: mmccrary2@student.gsu.edu

Subject: $10 Walmart Gift Card for Completing Questionnaire!!! (Instructional Coach Efficacy)

Body: So often, instructional coaches are placed in schools and asked to carry out a wide range of tasks with little relevant professional support. In efforts to better understand what an instructional coach needs in order to feel confident and effective in transforming teacher practice, we are conducting a survey of elementary instructional coaches. Your VOICE is vital in assisting reseachers and professional developers in better understanding the role that instructional coach efficacy (which is the extent to which instructional coaches believe they have the capacity to affect the learning and performance of their teachers) play in instructional coach efectiveness.
RESPONSES ARE CONFIDENTIAL. Therefore, please be as truthful as possible when responding to the questions.

Here is a link to the survey:
https://www.surveymonkey.com/s.aspx

This link is uniquely tied to this survey and your email address. Please do not forward this message.

Thanks for your participation!

Please note: If you do not wish to receive further emails from us, please click the link below, and you will be automatically removed from our mailing list.
https://www.surveymonkey.com/optout.aspx

« Back to Messages List

http://www.surveymonkey.com/MyCollector_Message_Summary.aspx?sm=dO5NM8%2fl... 3/14/2011

Appendix B

Coach Efficacy Questionnaire

Exit this survey

1. Demographic Information

1 / 2		50%

*

1. Which of the following best describes your current assignment?

Which of the following best describes your current assignment? I was hired specifically as an instructional coach to work with teachers in mathematics.

I was hired as an instructional coach to work with teachers in multiple subjects.

I am a classroom teacher who also coaches other classroom teachers in mathematics.

I have multiple responsibilities that include coaching other classroom teachers but not working as a classroom teacher.

None of the above.

*

2. The curriculum that my teachers/school uses to teach "mathematics" is (i.e., Project GRAD mathematics, America's Choice, Investigations, Direct Instruction, etc.)

The curriculum that my teachers/school uses to teach "mathematics" is (i.e., Project GRAD mathematics, America's Choice, Investigations, Direct Instruction, etc.)

3. Please rate the following question based upon your perspective of the teaching ability of mathematics teachers in your building (when taken together, what would be the average ability of the teachers who teach mathematics in your school)

	Very Poor				Excellent
From my perspective, my teachers' overall collective teaching ability is					

*

4. Please rate the following questions based on the level of support that you feel you have received as the mathematics coach.

	Not at all supportive				Very supportive
From my perspective, this year the principal has been		☐	☐		☐
From my perspective, members of the administrative team have been	☐	☐	☐	☐	☐
From my perspective, teachers have been	☐	☐	☐	☐	☐

*

5. What is the highest degree that you hold? (Choose one)

- ☐ What is the highest degree that you hold? (Choose one) BA or BS
- ☐ MA, MS, or MEd
- ☐ Multiple MA, MS, or MEd
- ☐ EdS
- ☐ PhD or EdD

Other (please specify)

*

6. Which of the following are true about your field(s) of study for the bachelor's degree? (Choose all that apply)

- ☐ I have a major in mathematics
- ☐ I have a major in a mathematics-intensive field (e.g., engineering, statistics, physics)
- ☐ I have a major in another field
- ☐ I have a minor in mathematics
- ☐ I have a minor in a mathematics-intensive field (e.g., engineering, statistics, physics)
- ☐ I have a minor in another field

7. If you have a graduate degree as well, what was your major field of study for that degree?

If you have a graduate degree as well, what was your major field of study for that degree? I don't have a graduate degree

- ☐ Elementary education
- ☐ Secondary education: mathematics
- ☐ Secondary education: other field
- ☐ Mathematics
- ☐ Other mathematics-intensive field (e.g., engineering, statistics, physics)

Other (please specify)

8. Including this school year to date, and rounding up to a whole numeral...

Including this school year to date, and rounding up to a whole numeral... How many school years have you taught (NOT COACHED) on a full-time basis at any grade level within grades K-12? (numeral, 0 or above)	
How many of those school years included teaching at any grade level within grades K-5? (numeral, 0 or above)	
How many of those school years included teaching mathematics at any grade level within grades K-5? (numeral, 0 or above)	

*

9. Including this school year to date, and rounding up to a whole numeral...

Including this school year to date, and rounding up to a whole numeral... How many school years have you served as a coach in one or more schools within grades K-12? (numeral, 0 or above)	
How many of those school years included coaching teachers at any grade level within grades K-5? (numeral, 0 or above)	
How many of those school years included coaching teachers of mathematics at any grade level within grades K-5? (numeral, 0 or above)	

Next

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Create your own free online survey now!

Coach Efficacy Questionnaire

Exit this survey

2. Instructional Coaching Efficacy

2 / 2		100%

10. For each of the following 24 questions, please rate the items on a scale from 1 to 5 based on how effective (or confident) you are with the various coaching functions as it relates to the TEACHERS THAT YOU CURRENTLY COACH.

	Not at All Effective/Confident	Very Effective/Confident
How effective do you feel coaching teachers on number sense and computation topics relevant to their classrooms?		
How effective do you feel coaching teachers on incorporating investigative, inquiry-based or discovery-based mathematics learning into their lessons?		
How effective do you feel coaching teachers on using questioning strategies such as higher-order questioning,		

	Not at All Effective/Confident	Very Effective/Confident
open questions or wait time?		
How effective do you feel coaching teachers on creating and using mathematical applications and connections for/in their mathematics classes?		
How effective do you feel coaching teachers on the use of cooperative learning?		
How effective do you feel coaching teachers on incorporating genuine mathematical problem-solving into their lessons?		
How confident are you with the mathematics taught at the GRADE LEVELS THAT YOU COACH?		
How effective do you feel coaching teachers on		

	Not at All Effective/Confident	Very Effective/Confident
mathematical content?		
How effective do you feel coaching teachers on mathematics-specific pedagogy? (Examples of mathematics-specific pedagogy include but are not limited to incorporating inquiry, discovery or investigative mathematics into lessons, and incorporating problem-solving and conceptual understanding into lessons.)		
How effective do you feel coaching teachers on "reading" or detecting students' levels of understanding?		
How effective do you feel coaching teachers on creating environments where students		

	Not at All Effective/Confident	Very Effective/Confident
listen to one another?		
How effective do you feel creating environments where teachers reflect openly on their instructional practices?		
How effective do you feel coaching teachers on general (not necessarily mathematics-specific) pedagogy? (Examples of general pedagogy include but are not limited to engaging students, use of questioning strategies, use of cooperative learning, and classroom management.)		
How effective do you feel coaching teachers on classroom management?		
How effective do you feel coaching teachers on encouraging		

	Not at All Effective/Confident	Very Effective/Confident
intellectual rigor, constructive criticism or challenging of ideas?		
How effective do you feel coaching teachers on engaging students in mathematical abstraction or sense-making?		
How effective do you feel coaching teachers on using strategies to increase student collaboration or dialogue among students?		
How effective do you feel coaching teachers on incorporating mathematics conceptual understanding into their lessons?		
How effective do you feel helping teachers set goals and objectives aimed at		

	Not at All Effective/Confident	Very Effective/Confident
improving their instruction?		
How effective do you feel coaching teachers on encouraging student participation?		
How effective do you feel modeling instruction for teachers?		
How effective do you feel creating an environment of open discussion and constructive criticism with teachers?		
How confident are you with the mathematical reasoning behind mathematics taught at the grade levels that you coach, meaning the understanding of "why" we teach it, "how" it relates to other mathematics topics, and "why" it is valid?		
How effective		

	Not at All Effective/Confident	Very Effective/Confident
do you feel observing lessons and giving teachers feedback?		

Prev Done

Powered by **SurveyMonkey**
Create your own free online survey now!

Appendix C

marshacecile • Sign Out •

My Surveys Address Book My Account Plans & Pricing + Create Surv

Coach Effectiveness Questionnaire Edit

View Summary
Edit Recipients
Edit Messages
Change Settings
Change Restrictions

Georgia State University Edit

Email Invitation NOT CONFIGURED

Message Summary

« Back to Messages List

Message Delivery Schedule

Send a Test Message | Schedule Delivery

The message has not been scheduled for delivery yet.

Message Recipients Edit

The message currently has 0 potential recipients.

Message Preview Edit

No recipients have been defined, so we can't generate a full preview of your message.

To:

From: mmccrary2@student.gsu.edu

Subject: We want to hear from YOU!!! (Coach Effectiveness Questionnaire)

Body: In efforts to identify driving forces that influence instructional coach outcomes/effectiveness, we are conducting a survey of elementary teachers who teach in a school that has a full-time instructional coach. Your VOICE is vital in assisting reseachers and professional developers in better understanding instructional coach outcomes that are effective in transforming teaching practice. You have been randomly selected to participate in this study. RESPONSES ARE CONFIDENTIAL. Therefore, please be as truthful as possible when responding to the questions.
Here is a link to the survey:
https://www.surveymonkey.com/s.aspx

This link is uniquely tied to this survey and your email address. Please do not forward this message.

Thanks for your participation!

Please note: If you do not wish to receive further emails from us, please click the link below, and you will be automatically removed from our mailing list.
https://www.surveymonkey.com/optout.aspx

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Appendix D

- -

Coach Effectiveness Questionnaire

Exit this survey

1. Coaching Relationship

1 / 6		17%

For each of the following questions, please rate the items on a scale from 1 to 5, with 1 meaning not at all and 5 meaning to a great extent. These ratings should be your overall assessment of the coaching. You are not averaging individual coaching sessions, but rather encapsulating your view of the quality of your coaching relationship over the academic year.

1. Interpersonal Communiation Skills

	Not at All	To a Great Extent
a. I felt comfortable communicating with my coach.		
b. I felt my coach respects my opinions and understands my situation and the challenges I face.		
c. I felt comfortable with my coach's reflecting on my teaching practices.		
d. I valued my coach's input.		

Next

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Coach Effectiveness Questionnaire

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2. Topics Discussed During Coaching

2 / 6		33%

Please rate each of the following statements on a scale from 1 to 5, with 1 meaning not at all and 5 meaning to a great extent. These ratings should be your overall assessment of what occurred during the coaching sessions. These are not value judgments -- just a measure of what topics were discussed. You are not averaging individual coaching sessions, but rather encapsulating your view of what was discussed during coaching sessions over the academic year. A low rating on an item means that you didn't focus on that particular topic, which is fine. You may not have focused on that topic for good reasons. We are simply keeping track of what you did discuss, not whether or not it needed to be discussed.

2. Topics Discussed: Mathematics Content

	Not at All	To a Great Extent
a. My coach and I discussed significant and worthwhile mathematical content.		
b. My coach and I discussed mathematical content that I teach.		

c. My coach and I discussed ways to increase the level of cognitive demand of the mathematical content I teach.	
d. My coach and I discussed mathematics content beyond the grade(s) I teach.	

3. Topics Discussed: Mathematical Concept & Inquiry (Math Pedagogy)

	Not at All	**To a Great Extent**
e. My coach and I discussed ways of incorporating investigative, inquiry-based or discovery-based mathematics learning into my lessons.		
f. My coach and I discussed ways to infuse more mathematical concept development into my lessons.		

g. My coach and I discussed ways to infuse more mathematical problem-solving into my lessons.
h. My coach and I discussed ways to engage students in thought provoking activities centered on important mathematical ideas.
i. My coach and I discussed ways to emphasize elements of mathematical abstraction or sense-making into my lessons.

4. Topics Discussed: Student-Centered/General Pedagogy

	Not at All	**To a Great Extent**
j. My coach and I discussed ways to encourage students to pursue intellectual rigor, constructive criticism and/or challenging of ideas.		
k. My coach and I discussed ways to increase student participation in mathematics lessons.		
l. My coach and I discussed ways to create an environment where students listen to one another's mathematical ideas.		

m. My coach and I discussed ways to "read" or detect students' levels of understanding of the mathematics being taught.
n. My coach and I discussed ways to improve the use of questioning strategies in the context of mathematics instruction (such as, but not limited to, higher-order questions, open questions or wait time).

5. Topics Discussed: Reflection and Planning

	Not at All	To a Great Extent
o. My coach and I set goals and objectives aimed at implementing ideas and addressing issues we discussed.		
p. My coach and I were reflective about my students' learning.		
q. My coach and I were reflective about my teaching practice.		

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Coach Effectiveness Questionnaire

Exit this survey

3. Instructional Coach Impact on Instruction

Please rate each of the following items on a scale from 0 to 5, with 0 meaning the topic wasn't discussed or was not a point of emphasis, 1 meaning no impact and 5 meaning very large impact. These ratings should be your overall assessment of the coaching sessions' impact on your instruction. These are not value judgments -- just a measure of whether or not your instruction changed because of the coaching sessions. You are not averaging individual coaching sessions, but rather encapsulating your view
of the sessions' impact on your teaching practices over the academic year. Please rate the LEVEL OF IMPACT ON YOUR INSTRUCTION for each of the following:

6. What level of impact did each of the following topics have on your instruction?

	Didn't discuss or Not a topic of interest	Discussed, but no impact	Moderate Impact	Very Large Impact
a. The mathematical content my coach and I discussed.				
b. Discussions with my coach about ways of incorporating investigative, inquiry-based or discovery-based mathematics learning into my lessons.				
c. Discussions with my coach about ways to infuse more conceptual understanding into my lessons.				
d. Discussions with my coach about ways to infuse more problem-solving				

	Didn't discuss or Not a topic of interest	Discussed, but no impact	Moderate Impact	Very Large Impact
into my lessons.				
e. Discussions with my coach about ways to “read” or detect students’ levels of understanding.				
f. Discussions with my coach about ways to improve the use of questioning strategies in the context of mathematics instruction (such as,but not limited to, higher-order questions, open questions or wait time).				
g. Discussions with my coach about ways to engage students in thoughtprovoking activities centered on important mathematical ideas.				
h. Discussions with my coach about ways to emphasize elements of mathematical abstraction or sensemaking in lessons.				

	Didn't discuss or Not a topic of interest	Discussed, but no impact	Moderate Impact	Very Large Impact
i. Discussions with my coach about ways to encourage student participation.				
j. Discussions with my coach about ways to encourage students to pursue intellectual rigor, constructive criticism and/or challenging of ideas.				
k. The goals and objectives my coach and I set aimed at implementing ideas and addressing issues we discussed.				
l. Discussions with my coach about my students' learning.				
m. Discussions with my coach about my teaching practice.				

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Coach Effectiveness Questionnaire

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4. Teacher satisfaction with Instructional Coach

4 / 6		67%

7. Please rate the following questions based on your overall satisfaction with the instructional coach that is assigned to your school.

	Very Little					Very Much
How much would you like to have the same coach next school year?						
How much do you like working with your coach?						
How much does your coach know about mathematics?						

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Coach Effectiveness Questionnaire

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5. Instructional Coach Interactions

5 / 6		83%

8. How often did your coaching sessions include a pre-lesson conference?

- Less than half the time, but sometimes
- Half the time
- More than half the time, but not always
- Always

9. How often did your coaching sessions include a lesson observation?

- How often did your coaching sessions include a lesson observation? Never
- Less than half the time, but sometimes
- Half the time
- More than half the time, but not always
- Always

10. How often did your coaching sessions include a post-conference?

- How often did your coaching sessions include a post-conference? Never
- Less than half the time, but sometimes
- Half the time
- More than half the time, but not always
- Always

11. During this school year, how often has your mathematics coach modeled a lesson for you?

- During this school year, how often has your mathematics coach modeled a lesson for you? Never
- Once
- Twice
- Three times
- More than three times

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Coach Effectiveness Questionnaire

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6. Demographic Information

6 / 6		100%

12. Including this school year, and rounding up to a whole numeral ...

Including this school year, and rounding up to a whole numeral ... How many years have you taught on a full-time basis at any grade within grades K-12? (numeral, 1 or above)

b. How many of those years included teaching at any grade within grades K-2? (numeral, 1 or above)

c. How many of those years included teaching mathematics at any grade within grades 3-5? (numeral, 1 or above)

13. What grade level do you currently teach?

- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5

Other (please specify)

14. Please indicate the number of school years (rounding up to a whole numeral) in which you have worked with:

Please indicate the number of school years (rounding up to a whole numeral) in which you have worked with: a. Your CURRENT instructional coach in mathematics.

15. What school do you currently teach in?

What school do you currently teach in?

16. Given your current assignment, and rounding up to a whole numeral ...

Given your current assignment, and rounding up to a whole numeral ... a. How many school years have you been at your present school?(numeral, 1 or above)

17. What is the highest degree that you hold? (Choose one)

- ☐ MA, MS, or MEd
- ☐ Multiple MA, MS, or MEd
- ☐ PhD or EdD
- ☐ Other (please specify)

18. Please indicate the number of mathematics content courses (not including methods courses) that you completed as part of your collegiate study for the bachelor's degree, and please identify the highest-level math course you took.

Please indicate the number of mathematics content courses (not including methods courses) that you completed as part of your collegiate study for the bachelor's degree, and please identify the highest-level math course you took. Number of courses (your best estimate, in numeral form, such as "0" or "3"):

19. At what levels are you certified to teach? (Choose all that apply)

- [ ] Elementary education
- [ ] Middle-level education
- [ ] Secondary education
- [ ] Other (please specify)

20. Do you hold a specific certificate or endorsement for teaching mathematics?

- [ ] Do you hold a specific certificate or endorsement for teaching mathematics? Yes
- [ ] No

21. During a complete school year, what is the typical number of coaching sessions (entered as a numeral) that you participate in with the coach assigned to you?

During a complete school year, what is the typical number of coaching sessions (entered as a numeral) that you participate in with the coach assigned to you?

Prev Done

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Appendix E

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The default error term in MANOVA has been changed from WITHIN CELLS to WITHIN+RESIDUAL. Note that these are the same for all full factorial designs.

* * * * * * * * * * * * * * * * * A n a l y s i s o f V a r i a n c e * * * * * * * * * * * * * * * * *

140 cases accepted.
0 cases rejected because of out-of-range factor values.
0 cases rejected because of missing data.
1 non-empty cell.

1 design will be processed.

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* * * * * * * * * * * * * * * * * A n a l y s i s o f V a r i a n c e -- Design 1 * * * * * * * * * * * * * * * * *

EFFECT .. WITHIN CELLS Regression
Multivariate Tests of Significance (S = 3, M = -1/2, N = 66)

Test Name	Value	Approx. F	Hypoth. DF	Error DF	Sig. of F
Pillais	.24989	4.11919	9.00	408.00	.000
Hotellings	.30022	4.42540	9.00	398.00	.000
Wilks	.76085	4.30873	9.00	326.27	.000
Roys	.19489				

\- -

Eigenvalues and Canonical Correlations

Root No.	Eigenvalue	Pct.	Cum. Pct.	Canon Cor.	Sq. Cor
1	.24206	80.62962	80.62962	.44146	.19489
2	.05775	19.23479	99.86442	.23365	.05459
3	.00041	.13558	100.00000	.02017	.00041

\- -

Dimension Reduction Analysis

Roots	Wilks L.	F	Hypoth. DF	Error DF	Sig. of F
1 TO 3	.76085	4.30873	9.00	326.27	.000
2 TO 3	.94502	1.93570	4.00	270.00	.105
3 TO 3	.99959	.05536	1.00	136.00	.814

- -

EFFECT .. WITHIN CELLS Regression (Cont.)
Univariate F-tests with (3,136) D. F.

Variable	Sq. Mul. R	Adj. R-sq.	Hypoth. MS	Error MS	F	Sig. of F
TotalBeh	.17755	.15940	13.92799	1.42323	9.78621	.000
TotalImp	.12859	.10936	18.59424	2.77964	6.68944	.000
TotalSat	.11258	.09301	6.67542	1.16070	5.75121	.001

- -

Raw canonical coefficients for DEPENDENT variables
Function No.

Variable	1	2	3
TotalBeh	1.43240	-.31081	-1.97082
TotalImp	-.50144	-.59432	1.71669
TotalSat	-.07581	1.58311	-.01857

- -

Standardized canonical coefficients for DEPENDENT variables
Function No.

Variable	1	2	3
TotalBeh	1.86384	-.40442	-2.56442
TotalImp	-.88586	-1.04994	3.03276
TotalSat	-.08576	1.79089	-.02101

- -

Correlations between DEPENDENT and canonical variables
Function No.

Variable	1	2	3
TotalBeh	.95402	.04915	.29568
TotalImp	.81148	.04570	.58259

TotalSat	.69118	.59627	.40832

- -

Variance in dependent variables explained by canonical variables

CAN. VAR.	Pct Var DEP	Cum Pct DEP	Pct Var COV	Cum Pct COV
1	68.21314	68.21314	13.29389	13.29389
2	12.00146	80.21460	.65520	13.94909
3	19.78540	100.00000	.00805	13.95714

- -

Raw canonical coefficients for COVARIATES
Function No.

COVARIATE	1	2	3
CE_Inter	2.02733	-.44627	2.35335
CE_MathC	.32104	1.46430	-1.00798
CE_Stude	-.09391	-1.19191	-2.64795

- -

Standardized canonical coefficients for COVARIATES
CAN. VAR.

COVARIATE	1	2	3
CE_Inter	.92828	-.20434	1.07756
CE_MathC	.19781	.90221	-.62106
CE_Stude	-.04280	-.54318	-1.20673

- -

Correlations between COVARIATES and canonical variables
CAN. VAR.

Covariate	1	2	3
CE_Inter	.98203	-.18268	.04740
CE_MathC	.57286	.73963	-.35324
CE_Stude	.58208	-.54378	-.60456

- -

Variance in covariates explained by canonical variables

CAN. VAR.	Pct Var DEP	Cum Pct DEP	Pct Var COV	Cum Pct COV
1	10.59776	10.59776	54.37887	

54.37887
2 1.59434 12.19210 29.20391
83.58279
3 .00668 12.19878 16.41721
100.00000

- -

Regression analysis for WITHIN CELLS error term
--- Individual Univariate .9500 confidence intervals
Dependent variable .. TotalBehavior Total Behavior

COVARIATE	B	Beta	Std. Err.	t-Value	Sig. of t	Lower -95%	CL- Upper
CE_Inter	1.1225995417	.3950356493	.31753	3.53536	.001	.49466	1.75054
CE_MathC	.1899950553	.0899659741	.18279	1.03941	.300	-.17149	.55148
CE_Stude	-.0898269576	-.0314604721	.29399	-.30555	.760	-.67121	.49155

Dependent variable .. TotalImpact Total Impact

COVARIATE	B	Beta	Std. Err.	t-Value	Sig. of t	Lower -95%	CL- Upper
CE_Inter	1.3234781035	.3430257619	.44376	2.98241	.003	.44591	2.20104
CE_MathC	.2098704976	.0731957607	.25545	.82156	.413	-.29531	.71505
CE_Stude	-.1368878211	-.0353119664	.41085	-.33318	.740	-.94938	.67560

Dependent variable .. TotalSatisfaction Total Satisfaction

COVARIATE	B	Beta	Std. Err.	t-Value	Sig. of t	Lower -95%	CL- Upper
CE_Inter	.6513792876	.2636518779	.28676	2.27154	.025	.08430	1.21846
CE_MathC	.3322050866	.1809371567	.16507	2.01246	.046	.00576	.65865
CE_Stude	-.2449389959	-.0986738270	.26549	-.92258	.358	-.76997	.28009

- -

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EFFECT .. CONSTANT
Multivariate Tests of Significance (S = 1, M = 1/2, N = 66)

Test Name	Value	Exact F	Hypoth. DF	Error DF	Sig. of F
Pillais	.11338	5.71191	3.00		

134.00 .001
Hotellings .12788 5.71191 3.00
134.00 .001
Wilks .88662 5.71191 3.00
134.00 .001
Roys .11338
Note.. F statistics are exact.

- -

Eigenvalues and Canonical Correlations

Root No.	Eigenvalue	Pct.	Cum. Pct.	Canon Cor.
1	.12788	100.00000	100.00000	.33672

- -

EFFECT .. CONSTANT (Cont.)
Univariate F-tests with (1,136) D. F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error MS	F	Sig. of F
TotalBeh	3.71435	193.55871	3.71435	1.42323	2.60981	.109
TotalImp	4.01817	378.03130	4.01817	2.77964	1.44557	.231
TotalSat	1.25877	157.85480	1.25877	1.16070	1.08450	.300

- -

EFFECT .. CONSTANT (Cont.)
Raw discriminant function coefficients
Function No.

Variable	1
TotalBeh	-1.19889
TotalImp	-.12158
TotalSat	1.44037

- -

Standardized discriminant function coefficients
Function No.

Variable	1
TotalBeh	-1.43026
TotalImp	-.20270
TotalSat	1.55179

- -

Estimates of effects for canonical variables

Parameter	Canonical Variable 1
1	3.84467

- -

Correlations between DEPENDENT and canonical variables

Variable	Canonical Variable 1
TotalBeh	-.38738
TotalImp	-.28830
TotalSat	.24972

- -

Abbreviated Name	Extended Name
CE_Inter	CE_InterpersonalCommunication
CE_MathC	CE_MathContentampPedagogy
CE_Stude	CE_StudentCenteredPedagogy
TotalBeh	TotalBehavior
TotalImp	TotalImpact
TotalSat	TotalSatisfaction

Appendix E

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The default error term in MANOVA has been changed from WITHIN CELLS to
WITHIN+RESIDUAL.  Note that these are the same for all full factorial
designs.

* * * * * * * * * * * * * * * * * A n a l y s i s   o f   V a r i a n c
e * * * * * * * * * * * * * * * *


       140 cases accepted.
         0 cases rejected because of out-of-range factor values.
         0 cases rejected because of missing data.
         1 non-empty cell.

         1 design will be processed.

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 * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
*
 *                   *
*
 *   W A R N I N G   * For WITHIN CELLS error matrix, these
*
 *                   * covariates appear LINEARLY DEPENDENT on
*
 *                   * preceding variables ...
*
 *                   *   Coach13
*
 *                   *   Coach14
*
 *                   *   Coach15
*
 *                   * 3 D.F. will be returned to this error term.
*
 *                   *
*
 * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
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* * * * * * * * * * * * * * * * * A n a l y s i s   o f   V a r i a n c
e -- Design   1 * * * * * * * * * * * * * * * *

 EFFECT .. WITHIN CELLS Regression
 Multivariate Tests of Significance (S = 3, M = 5 1/2, N = 60 )
```

Test Name	Value	Approx. F	Hypoth. DF	Error DF	Sig. of F
Pillais	.65429	2.30581	45.00	372.00	.000
Hotellings	.87350	2.34228	45.00	362.00	.000
Wilks	.47130	2.32595	45.00	363.21	.000
Roys	.31345				

- -

Eigenvalues and Canonical Correlations

Root No.	Eigenvalue	Pct.	Cum. Pct.	Canon Cor.	Sq. Cor
1	.45656	52.26794	52.26794	.55987	.31345
2	.26913	30.81027	83.07821	.46050	.21206
3	.14781	16.92179	100.00000	.35886	.12878

- -

Dimension Reduction Analysis

Roots	Wilks L.	F	Hypoth. DF	Error DF	Sig. of F
1 TO 3	.47130	2.32595	45.00	363.21	.000
2 TO 3	.68647	1.81818	28.00	246.00	.009
3 TO 3	.87122	1.40990	13.00	124.00	.164

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EFFECT .. WITHIN CELLS Regression (Cont.)
Univariate F-tests with (15,124) D. F.

Variable	Sq. Mul. R	Adj. R-sq.	Hypoth. MS	Error MS	F	Sig. of F
TotalBeh	.28013	.19304	4.39504	1.36627	3.21682	.000
TotalImp	.23845	.14632	6.89606	2.66430	2.58832	.002
TotalSat	.22950	.13629	2.72154	1.10531	2.46225	.003

- -

Raw canonical coefficients for DEPENDENT variables

Function No.

Variable	1	2	3
TotalBeh	-1.73357	-.69801	1.59374
TotalImp	.55123	.13999	-1.79673
TotalSat	.53349	1.27073	.78293

- -

Standardized canonical coefficients for DEPENDENT variables
Function No.

Variable	1	2	3
TotalBeh	-2.25572	-.90824	2.07378
TotalImp	.97381	.24732	-3.17415
TotalSat	.60351	1.43751	.88568

- -

Correlations between DEPENDENT and canonical variables
Function No.

Variable	1	2	3
TotalBeh	-.84337	.48997	-.22057
TotalImp	-.66764	.57309	-.47522
TotalSat	-.41799	.90662	-.05760

- -

Variance in dependent variables explained by canonical variables

CAN. VAR.	Pct Var DEP	Cum Pct DEP	Pct Var COV	Cum Pct COV
1	44.39126	44.39126	13.91452	13.91452
2	46.34873	90.73999	9.82861	23.74312
3	9.26001	100.00000	1.19248	24.93560

- -

Raw canonical coefficients for COVARIATES
Function No.

COVARIATE	1	2	3
CE_Inter	-6.37149	1.17947	.14871
CE_MathC	2.24433	-2.58335	.94795
CE_Stude	3.03398	-.78993	.39703
Coach1	-1.92138	-3.64471	1.64826
Coach2	-2.99446	1.31115	-.69021
Coach3	3.66826	-6.17775	1.07460

Coach4	-4.99893	2.56953	-1.14585
Coach5	-.36831	-3.55046	-.27621
Coach6	-2.21345	-.54423	2.88633
Coach7	-3.91997	-1.88009	.44622
Coach8	-1.03479	-3.39860	1.67845
Coach9	-3.32304	1.17428	-.49833
Coach10	-.62375	.74049	2.71014
Coach11	-.13885	-3.12197	1.90821
Coach12	-3.60305	-1.01256	.62009
Coach13	.00000	.00000	.00000
Coach14	.00000	.00000	.00000
Coach15	.00000	.00000	.00000

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Standardized canonical coefficients for COVARIATES
CAN. VAR.

COVARIATE	1	2	3
CE_Inter	-2.91740	.54006	.06809
CE_MathC	1.38282	-1.59171	.58407
CE_Stude	1.38266	-.35999	.18093
Coach1	-.66041	-1.25274	.56653
Coach2	-.50066	.21922	-.11540
Coach3	.80235	-1.35124	.23504
Coach4	-.72648	.37342	-.16652
Coach5	-.10347	-.99749	-.07760
Coach6	-.54482	-.13396	.71045
Coach7	-.91315	-.43796	.10395
Coach8	-.25470	-.83654	.41314
Coach9	-.77410	.27355	-.11608
Coach10	-.13643	.16196	.59278
Coach11	-.03037	-.68286	.41738
Coach12	-.88686	-.24923	.15263
Coach13	.00000	.00000	.00000
Coach14	.00000	.00000	.00000
Coach15	.00000	.00000	.00000

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Correlations between COVARIATES and canonical variables
CAN. VAR.

Covariate	1	2	3
CE_Inter	-.75359	.23320	-.04211
CE_MathC	-.33798	.48202	.26137
CE_Stude	-.50336	-.05663	-.13139
Coach1	.71573	-.45437	-.01385
Coach2	-.15210	.06012	-.02301
Coach3	-.00940	-.19034	-.16132
Coach4	.15155	.10879	-.10606
Coach5	-.33255	-.18657	-.43683
Coach6	-.15928	.20160	.54885
Coach7	-.02201	-.05230	-.14952
Coach8	-.08132	-.38366	.16632

Coach9	-.29952	.05248	.01438
Coach10	.22372	.27312	.53201
Coach11	-.19422	-.23367	.25232
Coach12	-.12374	-.07861	.02240
Coach13	-.27321	.32552	-.10912
Coach14	.37204	.58900	-.33229
Coach15	-.03034	.12188	-.12191

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Variance in covariates explained by canonical variables

CAN. VAR.	Pct Var DEP	Cum Pct DEP	Pct Var COV	Cum Pct COV
1	3.55906	3.55906	11.35441	11.35441
2	1.62497	5.18403	7.66285	19.01726
3	.82419	6.00822	6.40015	25.41741

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Regression analysis for WITHIN CELLS error term
--- Individual Univariate .9500 confidence intervals
Dependent variable .. TotalBehavior   Total Behavior

COVARIATE	B	Beta	Std. Err.	t-Value	Sig. of t	Lower -95%	CL- Upper
CE_Inter	4.2455834960	1.4939938694	2.13583	1.98779	.049	.01818	8.47298
CE_MathC	-2.2349815722	-1.0583027753	1.40541	-1.59027	.114	-5.01668	.54672
CE_Stude	-2.1368698176	-.7484048771	1.13034	-1.89046	.061	-4.37414	.10040
Coach1	-.0593109183	-.0156671419	.90318	-.06567	.948	-1.84696	1.72833
Coach2	2.2958114725	.2949995228	1.34317	1.70925	.090	-.36270	4.95433
Coach3	-4.1781541409	-.7023360169	2.48714	-1.67991	.095	-9.10089	.74459
Coach4	3.9437177930	.4404659921	2.57484	1.53164	.128	-1.15261	9.04004
Coach5	-.7876403006	-.1700627427	.96394	-.81710	.415	-2.69556	1.12028
Coach6	.9028879596	.1707954929	.58997	1.53040	.128	-.26483	2.07060
Coach7	1.8104844541	.3241249039	1.09655	1.65107	.101	-.35990	3.98087
Coach8	-.5348836775	-.1011816808	.49508	-1.08039	.282	-1.51479	.44502
Coach9	2.4377426975	.4364208241	1.27802	1.90744	.059	-.09181	4.96730
Coach10	.3215064289	.0540443308	.76778	.41875	.676	-1.19815	1.84117

```
 Coach11     -1.0277959656   -.1727696251         .75323       -1.36452
.175       -2.51864          .46305
 Coach12      1.8525628292    .3504414674        1.07260        1.72718
.087        -.27041         3.97553
 Coach13       .0000000000    .0000000000         .00000          .
.            .               .
 Coach14       .0000000000    .0000000000         .00000          .
.            .               .
 Coach15       .0000000000    .0000000000         .00000          .
.            .               .
 Dependent variable .. TotalImpact          Total Impact

 COVARIATE               B           Beta      Std. Err.        t-Value
Sig. of t     Lower -95%     CL- Upper

 CE_Inter     4.7124601349   1.2213992991        2.98256        1.58000
.117       -1.19087        10.61579
 CE_MathC    -2.9720321093  -1.0365446959        1.96257       -1.51435
.132       -6.85652          .91245
 CE_Stude    -2.4913603227   -.6426782994        1.57846       -1.57835
.117       -5.61558          .63286
 Coach1       -.9270444530   -.1803658178        1.26124        -.73503
.464       -3.42339         1.56930
 Coach2       2.7965995010    .2646756057        1.87567        1.49099
.139        -.91587         6.50907
 Coach3      -5.6262518123   -.6965915409        3.47315       -1.61993
.108      -12.50058         1.24808
 Coach4       4.8441841803    .3984976347        3.59562        1.34725
.180       -2.27255        11.96092
 Coach5      -1.3288783509   -.2113318837        1.34609        -.98721
.325       -3.99318         1.33542
 Coach6        .3383348826    .0471398144         .82386         .41067
.682       -1.29231         1.96898
 Coach7       1.5775515685    .2080174239        1.53128        1.03022
.305       -1.45327         4.60837
 Coach8      -1.4068515898   -.1960150322         .69135       -2.03492
.044       -2.77524         -.03847
 Coach9       2.8919520760    .3813355031        1.78468        1.62043
.108        -.64043         6.42433
 Coach10      -.0593690832   -.0073505422        1.07217        -.05537
.956       -2.18149         2.06275
 Coach11     -1.9387308587   -.2400360953        1.05184       -1.84318
.068       -4.02062          .14315
 Coach12      1.7203569340    .2396953753        1.49782        1.14857
.253       -1.24425         4.68497
 Coach13       .0000000000    .0000000000         .00000          .
.            .               .
 Coach14       .0000000000    .0000000000         .00000          .
.            .               .
 Coach15       .0000000000    .0000000000         .00000          .
.            .               .
 Dependent variable .. TotalSatisfaction          Total Satisfaction

 COVARIATE               B           Beta      Std. Err.        t-Value
Sig. of t     Lower -95%     CL- Upper
```

```
 CE_Inter     2.2403382262    .9067979160        1.92105        1.16620
.246       -1.56196        6.04264
 CE_MathC    -1.8364175379  -1.0002139680        1.26408       -1.45277
.149       -4.33839         .66556
 CE_Stude    -1.1855638567   -.4776051379        1.01668       -1.16611
.246       -3.19786         .82673
 Coach1      -1.2512483848   -.3801755234         .81236       -1.54027
.126       -2.85913         .35664
 Coach2       1.4281260014    .2110751532        1.20811        1.18212
.239        -.96305        3.81931
 Coach3      -3.9139481032   -.7567650042        2.23704       -1.74961
.083       -8.34167         .51377
 Coach4       2.5637540854    .3293581491        2.31592        1.10701
.270       -2.02010        7.14761
 Coach5      -1.5728922676   -.3906301157         .86701       -1.81415
.072       -3.28895         .14317
 Coach6        .2614572493    .0568890560         .53064         .49272
.623        -.78884        1.31175
 Coach7        .1393702719    .0286994282         .98629         .14131
.888       -1.81277        2.09151
 Coach8      -1.3704304430   -.2981844812         .44530       -3.07756
.003       -2.25180        -.48906
 Coach9       1.4459833514    .2977600226        1.14950        1.25792
.211        -.82920        3.72117
 Coach10       .4514865903    .0872952943         .69058         .65378
.514        -.91536        1.81833
 Coach11     -1.4823423199   -.2866120762         .67748       -2.18801
.031       -2.82327        -.14141
 Coach12       .4611338462    .1003355970         .96474         .47799
.634       -1.44836        2.37062
 Coach13       .0000000000    .0000000000         .00000         .
.           .              .
 Coach14       .0000000000    .0000000000         .00000         .
.           .              .
 Coach15       .0000000000    .0000000000         .00000         .
.           .              .

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e -- Design   1 * * * * * * * * * * * * * * * *

 EFFECT .. CONSTANT
 Multivariate Tests of Significance (S = 1, M = 1/2, N = 60 )

 Test Name             Value          Exact F       Hypoth. DF
Error DF        Sig. of F

 Pillais                .00000           .00000             3.00
122.00            1.000
 Hotellings             .00000           .00000             3.00
122.00            1.000
 Wilks                 1.00000           .00000             3.00
122.00            1.000
 Roys                   .00000
 Note.. F statistics are exact.
```

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Eigenvalues and Canonical Correlations

Root No.	Eigenvalue	Pct.	Cum. Pct.	Canon Cor.
1	.00000	100.00000	100.00000	.00000

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EFFECT .. CONSTANT (Cont.)
Univariate F-tests with (1,124) D. F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error MS	F	Sig. of F
TotalBeh	.00000	169.41713	.00000	1.36627	.00000	1.000
TotalImp	.00000	330.37306	.00000	2.66430	.00000	1.000
TotalSat	.00000	137.05790	.00000	1.10531	.00000	1.000

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EFFECT .. CONSTANT (Cont.)
Raw discriminant function coefficients
Function No.

Variable	1
TotalBeh	-1.27651
TotalImp	.50908
TotalSat	1.30385

- -

Standardized discriminant function coefficients
Function No.

Variable	1
TotalBeh	-1.49208
TotalImp	.83096
TotalSat	1.37078

- -

Estimates of effects for canonical variables
Canonical Variable

Parameter	1
1	8.89033

- -

Correlations between DEPENDENT and canonical variables

Canonical Variable

Variable	1
TotalBeh	.40263
TotalImp	.54021
TotalSat	.84030

- -

Abbreviated Name	Extended Name
CE_Inter	CE_InterpersonalCommunication
CE_MathC	CE_MathContentampPedagogy
CE_Stude	CE_StudentCenteredPedagogy
TotalBeh	TotalBehavior
TotalImp	TotalImpact
TotalSat	TotalSatisfaction