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Professional Development Effects on Elementary Principals' Attitudes Toward Implementing New Standards: A Randomized Control Trial

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PROFESSIONAL DEVELOPMENT EFFECTS ON ELEMENTARY PRINCIPALS' ATTITUDES TOWARD IMPLEMENTING NEW STANDARDS: A RANDOMIZED CONTROL TRIAL

By

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This work is dedicated to my family, to whom I owe everything that means anything.

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ABSTRACT

Principal support for implementing changes in policies and practices in the schools they lead is understood to be an important factor related to successful reform. Although professional development opportunities for educators are routinely used as a primary vehicle for knowledge dissemination around educational reform initiatives (e.g., new instructional standards and practices or changes in accountability policies), little is known about impacts of professional development for school principals. To add to the body of knowledge in this area, the current study reports on findings from a 2009 randomized field trial involving elementary school principals ($N = 110$) who completed both pre- and posttests of the Change Facilitator's Stages of Concern Questionnaire (CFSoCQ), a self-report measure of attitudes toward leading implementation of an innovation in their schools. In this study, the innovation was Florida's new content standards in mathematics and science, the Next Generation Sunshine State Standards (NGSSS). Key components of the intervention were designed to: improve principals' mathematics and science content knowledge; increase their knowledge of the NGSSS; strengthen their ability to observe teacher's instruction and provide feedback; and develop their ability to support communities of instructional practice in their schools. These professional development foci were aimed at building principals' will and capacity for successfully leading the transition to the NGSSS in their schools.

At pretest, the majority of principals in both the intervention and comparison groups reported that their primary concerns related to implementation of the new standards centered on a need for more information about the standards. Multinomial logistic regression (MLR) analyses suggest that assignment to the professional development condition was impactful for principals' self-reported attitudes toward facilitating the implementation of new content standards in their schools. At posttest, findings indicate that for principals assigned to professional development: the estimated odds of being focused on successful management of teachers' transition to the new standards were nearly four times higher than principals in the comparison condition; the estimated odds of being focused on the consequences of implementation of the new standards were more than six times higher than principals in the comparison condition; and the estimated odds of being focused on opportunities to collaborate with other administrators as they work to lead implementation of the new standards were nearly nine times higher than principals in the

comparison condition. Given the use of the Information stage (CFSoCQ Stage 1) as the outcome reference category for the MLR, these results suggest the intervention was effective at moving principals from a stage of wanting more information about the new standards to stages focused on: successful management of teachers' transition to the new standards; consequences of implementation of the new standards; and opportunities to collaborate with other administrators as they work to lead implementation of the new standards.

The results show that this intervention was successful for improving principals' readiness to lead their schools in the adoption of new mathematics and science content standards by moving them beyond a place of information-seeking to a focus on how best to manage, mitigate, and collaborate around the transition to the new standards. Study findings offer support for the use of professional development for school principals as a means of building principals' will to lead change efforts in their schools. In today's K-12 educational policy environment, principal support for the transition to the Common Core State Standards (CCSS) is likely to be a top priority for policymakers and state and district leaders in those states making this transition. The results of this study are particularly relevant in today's policy context given that the majority of states are working to transition to the CCSS.

CHAPTER ONE

INTRODUCTION

In 2008, the Florida legislature required the State Board of Education to review the *Sunshine State Standards* and replace them with the *Next Generation Sunshine State Standards* (NGSSS). The State Board of Education adopted the revised standards for mathematics, reading and language arts in 2007 and for science in 2008. The revision of the standards was undertaken in an effort to improve student performance via more rigorous and effective instructional standards.

The impetus for the revised standards arose, at least in part, from observed trends in student achievement on state- and national-level indicators: Florida Comprehensive Assessment Test (FCAT; Florida Department of Education, 2008), and National Assessment of Educational Progress (NAEP; National Center for Educational Statistics, 2007; Mello, Blankenship, & McLaughlin 2009; U.S. Department of Education, 2006), respectively; with FCAT mathematics results indicating that students' performance declined through elementary school, followed by the lowest levels of proficiency at sixth grade (Florida Department of Education, 2008). Florida's 2011 eighth grade mathematics NAEP results showed only 68% of students scoring at or above basic levels. Additionally, Florida ranked 40th on this measure of eighth grade math performance, below the national average of 72% students scoring at or above basic proficiency levels in eighth grade mathematics. FCAT science performance from 2003-2008 showed elementary students (grade 5) demonstrating higher levels of proficiency than secondary students (grades 8, 10, and 11); even at the elementary levels, however, only 35% of students scored at or above grade level (Florida Department of Education, 2008). Florida's legislature called for the revision of content standards partly due to the poor quality of the standards relative to other states (Peterson & Hess, 2008). One of the most important priorities for those states working to transition to new standards involves efforts aimed at building educators' understanding of why and how the standards are being implemented. With regard to the adoption of the Florida NGSSS, the revision of the standards created a need for principal leadership to support and manage the necessary changes in teacher practice to implement the new standards.

The aim of the policy mandate of new standards was intended, of course, to drive changes in teachers' classroom practice. Instructional changes are not easily adopted, and teachers frequently resist implementation of new policies and procedures that directly impact their practice (Snyder, Bolin, & Zumwalt, 1992; O'Sullivan, 2002). Resistance – or lack of will – is not the only threat to successful change in practice; even when teachers hold positive perceptions of the policy changes designed to improve instruction, implementation may be hindered for reasons ranging from misinterpretation of the policy to a lack of skills, knowledge, or both, or a lack of capacity required for successful implementation (Bekalo & Welford, 2000; Beretta, 1990). However, guidance and support from principals has the potential to influence changes in teachers' classroom practice via facilitation of development of both teacher will and teacher capacity to change instruction (Demetriadis, Barbas, Moholides, Palaigeorgiou, Psillos, & Vlahavas, 2003).

To meet high expectations for student learning, changes in teachers' practices need to be accompanied by assistive practices in administration and leadership (Leithwood & Jantzi, 2008; May & Supovitz, 2010; Nettles & Petscher, 1997; Supovitz, Sirinides, & May, 2010). Principals' influences on teachers' classroom practices stem from several leadership roles (Blasé & Blasé, 1998; Smith & Andrews, 1989). First, as teachers' supervisors, principals are uniquely situated to give feedback and guidance on instruction – especially with regard to areas in need of improvement (Elmore, 2000). When teachers attend professional development, principals are also able to hold teachers accountable for implementing what has been learned in those professional development activities (Hightower, 2002). Finally, administrator support is especially useful for allocation of resources to support instructional changes.

The uptake of new, more rigorous standards in mathematics and science is thought to require strong instructional leadership practices from principals, in part because most schools do not have coaches or specialists trained in mathematics and science leadership (Spillane, 2005). Studies demonstrate that teachers benefit from strong principal instructional leadership in mathematics when working toward changes in mathematics instruction (Nelson & Sassi, 2005). However, it is understood that school principals have varying levels of content knowledge in mathematics and science, with some possessing fairly limited conceptual knowledge to strong skills and understanding (Nelson, Benson, & Reed, 2004; Nelson, Reed, Johnson, & Benson, 2007). Research suggests that for administrators to impact student outcomes positively, strong

pedagogical content knowledge, which incorporates not only knowledge of the subject matter being taught but also administrator beliefs about what constitutes effective teaching in a specific content area, is crucial (Stein & D'Amico, 2000; Stein & Nelson, 2003). Thus, although teachers may benefit from strong principal instructional leadership, especially in mathematics and science content areas, principals may need to develop their own knowledge (both content and pedagogical content) in order to meet the needs of their faculty.

Principal knowledge, in itself, is thought to be insufficient for assuring their support for the uptake and implementation of educational initiatives (e.g., new standards), with principal attitude toward change being an important consideration (Goddard, Hoy, & Hoy, 2000). Changes that are meaningful and impactful are foundational in nature, rather than merely superficial, and require not only the acquisition of new knowledge for administrators and teachers, but also changes in educators' beliefs and attitudes about teaching, learning, and leading (Sparks, 2002). Studies indicate that principals' understanding of, and beliefs about, mathematics instruction influences how well they are able to identify high quality mathematics teaching and strategies for supporting that instruction (Nelson, 1998; Nelson, 2010; Spillane, Halverson, & Diamond 2004). Moreover, evidence suggests that principals' improved knowledge of both content and pedagogy may be achieved through professional development opportunities (Leithwood et al. 2004).

Research to date supports the investment in principal professional development aimed at improved implementation of educational innovations, as principals may need information and training focused on policy changes (Davis, Darling-Hammond, LaPointe, & Mereson, 2005). As change agents and instructional leaders, principals play a key role in the success of policies prioritizing changes in teaching and learning. One mechanism through which these changes are understood to be more or less successful is principals' attitudes toward the innovation or reform effort itself; that is, principals' willingness to lead the adoption and implementation of a change effort is important for successful implementation.

Purpose of the Study

Although learning through professional development opportunities, content knowledge, and pedagogical knowledge have been shown to be potentially important factors related to the exercise of instructional leadership, less is understood about the possible importance of principal characteristics (e.g., years of experience, gender, area of certification) in relation to the development of new knowledge and successful implementation of school reforms. Additionally,

research that has explored attitudes toward a reform as an essential consideration for successful reform implementation come primarily from business management literature, with relatively few studies targeting school leaders.

This dissertation is part of a larger project (Leadership for Mathematics and Science Instruction [LMSI]) aimed at professional development of Florida elementary school principals with the distal goal of improved student outcomes in mathematics and science. The goal of the LMSI professional development was facilitation of the implementation of the new mathematics and science standards (NGSSS). The primary objectives associated with this goal were improved principal content knowledge, pedagogical content knowledge, and understanding of the NGSSS. The particulars of these objectives stem directly from the increased academic rigor and pedagogical specifications present in the NGSSS. These new standards were understood to require administrator support for changes in teachers' instructional practices. Accordingly, additional objectives of the LMSI PD were to strengthen principals' ability to observe teacher's instruction and provide feedback and develop principals' ability to support communities of instructional practice in their schools.

The impact of professional development on principals' attitudes toward leading the adoption and implementation of the new standards is one of the more proximal outcomes of interest in the broader project, and the primary outcome of interest in the study reported here. In this study, I investigate the impact of participants' opportunity to participate in professional development on principals' attitudes toward implementation of Florida's NGSSS. Because there was some variation in the number of PD hours attended by principals, I will also report any change in principals' attitude associated with participating in the PD. Additionally, the importance of principal characteristics (e.g., years of experience, gender, and area of certification) as potential covariates and moderators will be investigated. This study employs a randomized design, with participants assigned to either professional development participation or a wait-list control condition. The primary data sources for this study are the Change Facilitators Stages of Concern Questionnaire (CFSoCQ; Hall, Newlove, George, Rutherford & Hord, 1991) and a participant information survey (e.g., demographics and background) developed by the research team.

Significance of the Study

This study adds to the current research base in two important ways. First, although research findings from various domains (e.g., educational research, organizational management) support professional development, knowledge, and attitudes as important aspects of successful reform implementation, there are few studies that allow any causal inferences to be made. Second, across the constructs of interest in this study (professional development, knowledge, and attitude) the research literature tends to focus either on teachers or business managers rather than principals. Experimental studies of professional development impacts on principals are scarce in the research literature. Furthermore, the investigation of principal characteristics as potentially important covariates is an area that is not widely covered in the experimental research literature.

Policymakers interested in school change initiatives can potentially use the findings of this study to inform decisions about the relative importance of professional development for school principals in leading reform efforts. Researchers planning to study professional development for principals may also find this investigation useful. Those interested in attitudes toward change, organizational management, school reform, or intervention research with school principals will also likely find these results worthy of review, particularly as the study is designed to allow for causal inference through the use of a randomized design. Perhaps most relevant, though, is the timeliness of this report given the majority of states' adoption and transition to the CCSS; results of this investigation have the potential to inform how principals' will for implementation may be developed.

Overview of the Research Design

Participants and Data Sources

All public elementary principals in Florida were invited to participate in professional development funded by the Florida Department of Education through the Partnership to Rejuvenate and Optimize Mathematics and Science Education in Florida (PROMiSE). Principals who registered to receive the professional development were randomly assigned to either a professional development treatment or waitlist control condition. Registered principals, in turn, were invited, by mail and email, to participate in the LMSI research study. Participation in the LMSI research project was not a requirement for receipt of professional development. The study described here (i.e., investigation of principals' attitudes toward leading the adoption and implementation of the NGSSS in their schools) represents only one component of the broader

LMSI project. The primary outcome of interest here, principal attitude toward leading the adoption and implementation of the new NGSSS, was measured using the CFSoCQ, a 35-item Likert-type questionnaire designed to measure principals' attitudes toward changes related to the adoption of the NGSSS in their respective schools. A general survey used to gather demographic information was developed by the research team and will be used as the source for potential covariates (e.g., years of experience, gender, and area of certification).

Research Questions

The research questions guiding this study aim to determine (a) whether professional development is an effective method for influencing principals' attitudes toward leading a change effort and (b) whether principal characteristics are associated with the impacts of participation in professional development. Formally, the study is designed to answer the following questions:

1. Did opportunity for participation, or assignment to treatment, in LMSI professional development impact principals' attitudes toward leading the implementation of NGSSS?
2. Did participation in LMSI professional development impact principals' attitudes toward leading the implementation of NGSSS?
3. Did principal characteristics, such as years of experience, gender, or area of certification, moderate the impact of LMSI professional development on principals' attitudes toward leading the implementation of NGSSS?

Methodology

Multinomial logistic regression (MLR) is used to analyze both pre- and post-test data on principals' attitudes toward mathematics and science reform. Whereas logistic regression is used with binary dependent variables to compare the probability of membership in one category to the probability of membership in the reference category, MLR is used for DVs with more than two categories to compare the probability of a case falling into a specific category to the probability of membership in the reference category (Hosmer & Lemeshow, 2000). These categories may be either ordered or unordered (Hosmer & Lemeshow; Long, 1997). Because there is a lack of consensus in the literature on whether the CFSoCQ stages should be considered as nominal or ordinal (Cotabish & Robinson, 2012), MLR analyses are supplemented by OLS regression analyses treating the CFSoCQ stages as linear and ordinal.

Overview of Chapters

This study is organized into five chapters. Chapter 1 includes an introduction, purpose, significance of the study, and overview of the research design. Chapter 2 provides a review of the literature relevant to the research questions (i.e., importance of principals for successful teaching and learning, principals' roles in successful reform efforts, professional development for teachers, professional development for principals, and attitudes toward change). Chapter 3 explicates the design, sample, research methodology, data sources, and statistical approaches applied in the study. Chapter 4 offers descriptive statistics on the study participants, followed by the OLS regression and MLR results of treatment effects and investigation of potentially important covariates and presence of moderation. Finally, Chapter 5 presents a summary of findings, discussion of results, limitations, implications, and next steps.

CHAPTER TWO

LITERATURE REVIEW

This review of the literature will report available information regarding the (1) importance of the principal for school success, (2) reform implementation, (3) studies of the principal's role in reform, (4) professional development effectiveness, (5) professional development for principals, (5) the significance of principal characteristics, and (6) gaps in the literature related to this study.

The Importance of the Principal

The idea that effective principals are critical for school success has a rich history in qualitative studies of educational practices (Purkey & Smith, 1982), with fewer quantitative studies available. Principal leadership has been shown to influence both school environment and classroom teaching practices (Davis & Bloom, 1998; Hallinger & Heck, 1998). Some estimates suggest that principals may account for as much as one-fourth of the between-school variation in students' academic achievement (Hallinger & Heck, 1998; Leithwood & Jantzi, 2008; Leithwood & Mascall, 2008; Robinson, Lloyd, & Rowe, 2008; Waters, Marzano, & McNulty, 2004). Additionally, principals' instructional leadership skills are believed to be instrumental in the effectiveness of some instructional interventions (Levine & Lezotte, 19905). Recent trends in principal evaluation center on the principal's ability to establish strong, collaborative instructional practices in schools (Davis, Kearny, Sanders, Thomas, & Leon, 2011; Weindling, 2000). These leadership abilities are expected to translate into improved student scores, as measured by standardized state assessments (Clifford, Behrstock-Sheratt, & Fetters, 2012).[1]

As school leaders, principals shoulder the majority of the responsibility for improved student achievement (Murphy, 1995). Most available evidence suggests that principals influence student performance indirectly through their ability to impact the people and practices in their schools (Leithwood, Louis, Anderson, & Wahlstrom, 2004). Although the precise relation between principal instructional leadership and individual student achievement is not fully understood, a convergence of evidence supports the importance of school principals for

[1] As of the 2011-2012 school year, Florida's principal evaluations were determined (50%) by student academic achievement (Florida Statute 1012.31, 2012).

successful teaching and learning (Ediger 2002; Hallinger & Heck 1996; Leithwood, et al.,2004; Levine & Lezotte 1995; Witziers, Bosker, & Kruger, 2003). Additionally, research findings suggest that strong, effective teachers are critical for students' academic success (Darling-Hammond, 2000) to the extent that principals influence teacher effectiveness – via hiring, supervision, retention practices, and instructional leadership – they have the opportunity to impact teacher effectiveness in their schools (Beteille, Kalogrides, & Loeb, 2009). Leithwood et al. (2004) maintained that principal leadership is the second most influential school factor impacting students' academic performance, behind classroom instruction, accounting for significant school-related effects.

Principals can influence the quality of their schools through the creation of learning environments that foster achievement and by focusing improvement efforts on the practices most likely to result in improved student outcomes, including the development of teachers' instructional knowledge and skills (Crow, Hausman, & Scribner, 2002; Day, Sammons, Hopkins, Leithwood & Kington, 2006; Hallinger, Bickman, & Davis, 1996; Hallinger & Heck, 1996; Marks & Nance, 2007; Mulford, 2005; Nettles & Herrington, 2007). Principals' abilities to plan strategically and facilitate change have been found to be correlated with improved student academic outcomes (Marzano, Waters, & McNulty, 2005). In a meta-analysis of 300 studies (primarily unpublished dissertations) on leadership behaviors and student outcomes, Marzano et al. suggested that the aforementioned behaviors (i.e., strategic planning and change facilitation) be prioritized by principals looking to impact learning in their schools positively.

A study by Heck & Marcoulides (1990) sought to test a theoretical causal model of principals' influence on students' academic achievement via their role as instructional leaders. Heck and colleagues mailed questionnaires to principals in elementary and high schools identified by California Assessment Program (CAP) scores as high- or low-performing and asked the principals to deliver the questionnaires to six teachers, who were chosen by the researchers at random, in the school. To be included in the analytic sample, the principal had to have been in the school for at least three consecutive years, and at least four of the six teachers had to complete and return the questionnaire. The questionnaire employed a five-point Likert-type scale to assess the relative frequency of implementation of thirty-four instructional leadership behaviors. The authors theorized that three principal latent traits (i.e., school governance, instructional organization, and school climate) would impact students' academic achievement.

The measure of student achievement used was CAP test scores for reading and math. The analytic sample included 332 teachers and 56 elementary and secondary school principals. There was good balance between elementary/secondary and low vs. high-performing schools, with the sample nearly evenly divided. Altogether, this evidence suggests principals are most influential via their work to: (a) recruit, retain, and develop effective teachers; (b) operate as instructional leaders for their faculty; and, (c) plan strategically and facilitate change.

Reform Implementation Literature

With the release of *A Nation at Risk* (National Commission of Excellence in Education, 1983), an emphasis on the school principal as instructional leader intensified. Political leaders and stakeholders responded to the national report with demands for improved student achievement and implementation of school reforms. It has been argued that principals are responsible for setting the foundation for change in their schools (Peterson & Deal, 1998), with the role of the principal as a supporter of educational reform, or agent of change, being a necessary, but insufficient, component of successful reform implementation (Leithwood et al., 2004; Muncey & McQuillan, 1996). The relation between leadership support and organizational change is understood to be fundamental for efficacious change efforts; the ability to effectively lead organizational change efforts is one of the skills that differentiate managers from leaders (Bruckman, 2008). Moreover, as school leaders, principals are uniquely well positioned to either facilitate or hinder reform efforts by leveraging both their opinions of the proposed changes and the decisions they make regarding implementation (Nelson & Sassi, 2000).

Broadly speaking, organizational change and reform are difficult to manage effectively and implement; it is estimated that the failure rate for organizational change initiatives is close to 80% (Black & Gregersen, 2008). Researchers focused on organizational change have noted that there is a type of organizational inertia, or resistance to change, which is often encountered when new initiatives are undertaken (McMillan, 2004; Dunoon, 2008). Osland (2008) maintains that change requires new attitudes, skills, and behaviors that must be, over time, embraced by an organization, and the individuals working there, for any long-term effects to be realized. Looking to the literature on business leadership, organizational researchers (Kotter & Schlesinger, 2008) posit that one of the primary reasons employees resist organizational change is due to their concerns regarding their ability to develop new skills and acquire new knowledge required for

the successful implementation of organizational reforms; as with educational reform efforts, there is a need to build both will and capacity for change.

Effective leadership of a change initiative requires not only a commitment to the proposed change, but also the leader's ability to identify specific obstacles in his or her organization that must be overcome or managed in route to the new way of working (Black & Gregersen, 2008). There are many theories around leadership for change efforts, and several of them prioritize leaders' abilities to inspire and motivate employees to embrace a change effort (Lewin, 1951). In general, literature on organizational change highlights the importance of leaders' choice, attitude, beliefs, and power for successful change efforts (Dawson, 1996; Senge, 1990). Managers in business organizations are commonly viewed as change agents who shape the process and conditions of change in their workplaces (Hartley, Benington, & Binns, 1997).

Early research on policy implementation reveals several important considerations regarding successful reform. First, implementation is difficult to effectively achieve for various reasons, ranging from politics and bureaucracy (Murphy, 1971), to failure of policymakers to account for school culture (Sarason, 1971) and lack of sufficient knowledge and training on the part of implementers (Gross et al., 1971). Additionally, people tend to be most comfortable with working routines they have already established and changes in attitudes and behavior in the workplace can be particularly difficult to manage (Dunham, 1984).

A seminal study of policy implementation, the Rand Change Agent Study (Berman & McLaughlin, 1978), a longitudinal evaluation of 293 federally funded projects in 18 states, concluded that overall, the federally funded policy changes had not been successfully implemented. In the Rand Change Agent Study, there were a few important exceptions, however; notably, these successes involved modifications of both the policy particulars and the behavior of those responsible for implementation. The authors termed this process one of "mutual adaptation" and contrasted it with the more prescriptive and procedural, or "cookbook" approach often observed in instances of failed implementation (p.12). Specifically, the authors reported that when policy design was modified to fit local conditions, successful implementation could be achieved. Success, however, was also conditional on the implementers' accurate understanding of the policy objectives; these successful cases all involved strong leadership for change.

In another early qualitative year-long study of a reform effort requiring changes in teachers' classroom practice, Gross, Giacquinta, and Bernstein (1971) began their investigation

with the expectation that teachers' lack of motivation would be the primary barrier to successful implementation. They concluded, however, that the obstacles to success involved: lack of teachers' understanding of what they were supposed to do; lack of knowledge and skill for successfully changing teaching practices; lack of appropriate curricular materials and resources; and, after experiencing the abovementioned obstacles, loss of motivation for implementation. The Gross et al. study highlighted the importance of not only clearly communicating to school personnel what the policy objectives are but also the need to provide necessary professional development centered on essential knowledge and skills for successful instructional changes. The authors underscored their observation that even when teachers had the will to implement, many lacked the capacity to make necessary changes to their instructional practice; thus, those teachers' classrooms looked very much the same pre- and post-implementation. School administrators in this study expressed concerns over a lack of resources, namely time and materials, for new teaching practices to be successfully implemented.

When interpreting results from studies of policy implementation, evidence suggests that it may be important to consider both the duration of a change effort and the types of policies being investigated. Early investigations of policy outcomes pertaining to educational reforms initiated during the War on Poverty suggested that by and large, these policies failed to impact schools. Researchers Kirst and Jung (1980) questioned this finding, and determined that by the late 1970s there were instances of successful implementation. Sufficient time is thought to be particularly important in the case of redistributive policies (e.g., Title I), which are complex and require high levels of skill on the part of those responsible for directing the programs (Peterson, Rabe, & Wong, 1986), as contrasted with more basic regulatory policies, such as the number of mathematics courses required for high school graduation. With regard to Title I outcomes, Kirst & Jung (1980) suggested that it may be necessary to study implementation over the course of several years, or as much as a decade, due to the time required for successful change efforts to be realized. Relatively little is known about the length of time required to observe measurable, and practically important, changes resulting from implementation of regulatory policies (e.g., new standards) with complex aims including not only the uptake of new programs or procedures, but also core changes in the practices and beliefs of school personnel (Coburn, 2003; Cohen & Ball, 2001; Elmore, 1996). Some researchers studying educational reform implementation have

hypothesized that positive, and meaningful, changes in teaching and learning may take five, ten, or more years to realize (e.g., Weiss & Paley, 2006).

Taken together, the implementation literature suggests that successful implementation is indeed possible, but often difficult, requiring substantial support on the part of implementers, and sufficient time to realize policy objectives. The role of the school principal has been operationalized as that of policy implementer (Fowler, 2009). One aspect of successful leadership for school change involves principals' transitioning to a role of facilitating school change, as opposed to managing the status quo (Frederick, 1992). This active change facilitation role is thought to involve several steps: understanding the change or reform being implemented, acceptance and support of the proposed change, and identification of the needs of faculty and staff associated with implementation (Louis & Miles, 1990). Principals may be hindered in their efforts to facilitate change if any of these requirements - understanding, accepting, and being able to identify staff needs – are not met (Hallinger, Murphy, & Hausman, 1992). Some researchers estimate that with regard to reform implementation, principal tenure at a given school in excess of five years is needed to fully implement policies and practices that may lead to students' improved academic performance (Seashore-Louis et al., 2010).

Studies of the Principal's Role in Reform

Experimental studies linking school principals directly to the success of reform efforts are scarce. Miles and Huberman (1984) reported results from a three-year, multi-site study of a variety of school reform efforts. Of the 146 school sites evaluated, 12 were chosen for in-depth case studies. These twelve schools were located in ten different states, and included rural, suburban, and urban settings. The results of implementation in these 12 sites were wide-ranging, from what the authors termed extremely successful to miserable failures. Most schools fell somewhere in between those two extremes. In the two cases that were considered to be miserable failures, Huberman and Miles identified resistance to the policy changes *on the part of the school principal* [emphasis added] as the primary reason for lack of policy implementation. The authors reported, however, that it would be difficult to criticize these school principals, because the policies being promoted by their district-level administrators were poorly designed, and lacked district support. In fact, it was the opinion of the authors that the principals' refusal to support the policy changes demonstrated a determination to protect their schools from "poorly conceived ideas" (p. 269). Likewise, the authors decided that administrator support was critical for

successful implementation in the two schools where successes were realized. In both of the schools deemed to be extremely successful with regard to implementation, the reform initiatives involved significant changes in teachers' instructional practices. This study provided support for principals' influence on policy implementation.

In a study examining the policy choices of Florida elementary school principals, Cannon, Sass and Figlio (2010) found that the most effective principals, identified via value-added models, prioritized implementation of policies that were related to improved student performance for the lowest-performing students in the schools, policies aimed at improved performance of the lowest performing teachers in their schools, and increased resources for teachers. Other value-added research highlights the tendency for effective principals to implement changes around teacher staffing to realize gains in student performance, with those principals skilled at retaining high value-added teachers, not surprisingly, having higher value-added estimates themselves (Jacob, 2010). It has been argued that one of the most important influences effective school principals employ is the ability to recruit and retain highly effective teachers (Beteille, Kalogrides, Loeb, 2009); this ability to recruit and retain highly effective teachers requires skill on the part of the principal for identifying effective teachers and classroom instruction.

Importance of principal attitudes toward reform. Principal knowledge, or understanding of a reform initiative, is thought to be necessary but insufficient for leading the uptake and implementation of educational initiatives (e.g., new standards), with principal attitude toward change also being an important consideration (Evans, 1999; Goddard, Hoy, & Hoy, 2000). The available research literature on principals' attitudes toward change initiatives is limited, but organizational research provides some guidance in this regard. Attitude toward organizational change has been operationalized as an employee's positive or negative evaluative judgment of a change initiative being implemented by his or her organization (Lines, 2005). Lines maintained that a positive attitude toward a change initiative is associated with efforts to facilitate the change, while negative attitudes are correlated with resistance to change. Organizational management researchers have suggested that in order to realize successful reforms, positive changes or perceptions in employees' attitudes and beliefs are required (Piderit, 2000); merely overcoming resistance to change is insufficient (Cunyat & Melguizo, 2013). Moreover, research demonstrates that employees' attitudes toward organizational change are a vital component to either the success or failure of those change efforts (Adams & Eby, 1998;

Huberman & Miles, 1984). Positive attitude toward change is associated with confidence in one's ability to meet the requirements of the change initiative, as well as the ability to learn about specific practices and skills required for successful change (McKenzie & Hodge, 1999). Learning through professional development opportunities is reported to be one of the most important tools school principals rely on for success as administrators (Marsh, Hamilton, & Gill, 2008; Nelson & Sassi, 2005); professional development trainings are one of the most common tools for providing educators with knowledge related to policy changes (Kelley & Peterson, 2008).

Effectiveness of Professional Development

Although evidence suggests that professional development is central to improved instruction (Joyce & Showers, 2002) and has the potential to improve student outcomes in reading, math and science (Yoon, Duncan, Lee, Scarloss, & Shapley, 2007), traditional forms of training for practicing educators in the United States (i.e., one- or two-day programs without follow-up) have had little impact on teacher practice and student achievement (Joyce & Showers, 2002; Garet, Porter, Desimone, Birman, & Yoon, 2001). Other research has suggested that high quality professional development is focused on student work (Desimone, Porter, Garet, Yoon, & Birman, 2002; Supovitz, 2002) and the relationship between instruction and student learning (Robinson, Lloyd, & Rowe, 2008). Further, effective professional development provides for collective participation, with opportunities for collaboration and coherence, linking new concepts and skills to other experiences and prior knowledge (Desimone, 2009; Desimone et al., 2002), and focuses on the content area taught by the participants (Desimone, 2009; Kennedy, 1998; Ma, 1999).

Desimone (2009) advanced a professional development framework based on what has been shown to relate to changes in teachers' knowledge and professional practice. This framework outlines critical components of professional development opportunities: active learning, content focus, coherence, duration, and collective participation. It is widely accepted that professional development is considered an "essential mechanism for deepening teachers' content knowledge and developing their teaching practices" (Desimone, Smith, & Ueno, 2006, p. 181). Additionally, professional development is necessary for positive school change, being seen as the "core of school improvement efforts" (Desimone et al., 2006, p. 181). Cohen & Hill, 2001 suggested that content-focused professional development is crucial for changing teacher

behavior. Evidence supports the incorporation of both subject matter and pedagogical content in professional development opportunities for teachers, with research findings suggesting that the inclusion of only one of these foci (i.e., subject matter or pedagogy) tends to be associated with less robust outcomes, especially for math and science professional development (Kennedy, 1999; Scher & O'Reilly, 2009).

Experimental evidence on science-content professional development for teachers offers support for content-focused professional development. In one randomized control trial, Heller, Daehler, Wong, Shinohara, and Miratrix (2012) compared three common forms of teacher professional development. The study included teachers from 39 schools in six states, with teachers randomly assigned to receive professional development on science content, supplemented with one of three foci: (a) how to teach using case studies (i.e., real-life scenarios and problems), (b) focus on student work, (c) use metacognitive analysis, or a (d) "business as usual" control condition. The analytic sample included 270 elementary teachers and 7,000 students. Statistically significantly higher science test scores for teachers and students were reported for all three professional development conditions, as compared to the control condition. The results held one year post experiment. The strongest results were found for the condition that supplemented science content with metacognitive analysis (i.e., required teachers to consider student thinking). These results lend support to the LMSI professional development focus on teaching principals about communities of instructional practice with a focus on student work (see Logic Model, Table 12, Phase 2, Appendix A). A quasi-experimental study of the Science Teachers Learning through Lesson Analysis (STeLLA; Roth, Garnier, Chen, Lemmens, Schwille, & Wickler, 2010) project also provided limited support for content-focused professional development. Teachers (n = 48) self-selected into one of two professional development opportunities: science content-only, or STeLLA, which includes both science content and lesson analysis. Teachers in the STeLLA program learned how to use videos of their instruction as tools for reflection and refinement. At post-test, teachers in the STeLLA condition had higher scores on a test of science content knowledge compared to the content-only participants; because teachers self-selected into the professional development condition, these findings, while interesting, are in need of confirmation.

Principal Professional Development Programs Reviewed

Research literature indicates that principals often move through professional development programs with little or no continuity among trainings (Joyce & Showers, 2002). This is in part due to the variety of professional development programs available to principals and administrators. There are local, regional, and national opportunities for continued learning, and many administrators have a potpourri of professional development "training" experiences. At the national level, many associations offer programs, e.g., the National Association of Secondary School Principals, the Association for Supervision and Curriculum Development, the NSDC, and the National Association of Elementary School Principals. Add to this the offerings from universities, private-sector/for-profit providers, state associations, district leadership academies, regional laboratories, and others, and the choices for principals are both copious and disconnected. As administrators move through the process of selecting professional development programs for themselves, there are no guarantees for the quality and usefulness of many of these programs.

Peterson (2000) highlighted multiple examples of local principal professional development programs that have many of the key features of effectiveness. These included: the Gheens Academy (Louisville, KY), the Mayerson Academy (Cincinnati, OH), and the Ohio Principal Leadership Academy. Because these programs are offered at the local level, their ties to district and state certifications and initiatives are strong. Additionally, the opportunities for feedback and collaboration are optimized.

Two well-known national principals' academies, the Harvard Principals' Center Institutes (Barth, 1984) and the Vanderbilt International Principals' Institute (Peterson, 2000), include many of the features theorized to be critical for effective principal professional development. Although these programs do not employ identical approaches, they do share some common features. Both programs include an emphasis on strengthening school cultures and creating a vision for one's school. These programs both provide excellent networking opportunities for administrators. The Harvard Principals' Center Institutes offer different programs with specific topics, for example, The Art and Craft of the Principalship, Leadership: An Evolving Vision and the Institute for School Leadership. The Vanderbilt International Principals' Institute covers a broad range of topics, but targets instructional leadership training for participants. Neither of these popular national programs is tied to any specific local initiatives, mandates, or procedures.

Both programs include most of the key features of effective professional development outlined in the literature but lack the opportunity for job-embedded training, may or may not be considered long-term, depending on one's opinion, and are not linked directly to any state/local endorsements and/or certifications.

Two comprehensive programs, the California School Leadership Academy (CSLA) and Coaching Leaders to Attain Student Success (CLASS) include all of the key features suggested for successful principal professional development (Marsh, 1992; Peterson, 2000). As an added support, these programs also offer ongoing training with an eye to career stages, and may differentiate participants based on years of experience as administrators. The main programs offered through CSLA are: Foundation 3.0, School Leadership Team, and Ventures. The Foundation 3.0 program is a 2 to 3 year commitment, and is available to principals at all career stages. The School Leadership Team Program is not limited to administrators, but is open to teams of school staff seeking to build and strengthen their focus on student achievement. This program includes approximately 15 days of seminars over a 2 or 3 year period, with team members engaging in the same number of training days at their individual school site. The Ventures Program offers an opportunity for experienced principals to study their own schools for 3 years. This program is broken into 3 phases, with emphases on documentation of change, analysis of school data, and the role of principal as change agent (Peterson, 2002).

The U. S. Department of Education (2008) in a report on educational innovations reports on several programs. Chicago Public Schools, in partnership with the Chicago Principals and Administrators Association (CPAA) offers a thorough professional development sequence to its administrators. The broad program, CLASS, is comprised of several structured programs: LAUNCH for principals-to-be, LIFT for beginning (1st year) principals, and for experienced principals, the Chicago Academy for School Leaders (CASL).

Davis, Krasnoff, Moilanen, Sather, and Kushman, of the Northwest Regional Educational Laboratory (2007) reported that struggling schools in its six state region (Washington, Oregon, Montana, Idaho, Oregon, and Alaska) that were able to demonstrate improvements in students' academic achievement made use of principal professional development as part of a molar package of school improvement strategies. Moreover, those schools utilized professional development opportunities that incorporated the key features of effective or successful programs identified above. These results do not offer evidence of

causation, as there was no means for isolating the effects of the professional development from the other possible causes of improvement. It is also quite possible that the effects of principal professional development are most potent when combined with other school supports.

A mixed methods study (Quint, Akey, Rappaport & Wilner, 2007) conducted in 49 schools serving large numbers of at risk students suggests principals make a substantial contribution to the effects of teachers' communities of practice and their impact on instruction. This study also found that delivering professional development to principals was a first step in increasing professional development opportunities for teachers and in increasing principal engagement with teachers in efforts to improve instruction. Higher levels of participation in instruction-related professional development for principals were significantly and positively related to their involvement in teacher professional development. Further, the findings indicated that increasing teacher participation in instruction-focused professional development helped to improve the effectiveness of their instruction. Importantly, in both reading and mathematics, higher levels of participation in instruction-focused professional development were related to higher levels of student achievement. Limitations in study design preclude the possibility for causal claims. However, these findings suggest that more definitive studies addressing the links among instruction-focused principal professional development, teacher professional development, high quality instruction, and student achievement are warranted. Again, there is no evidence to allow for causal claims that, through participation in these programs, principals were able to improve students' performance in their schools. The programs reviewed here are offered as examples demonstrating the key features identified in the literature as requirements for professional development programs leading to improved instructional leadership.

The Significance of Principal Characteristics

The potential importance of principal characteristics in relation to their role as change facilitators has been noted in previous scholarly work. Specifically, it has been suggested that gender may be one of the most influential principal characteristics impacting power relations within schools (Apple, 1994; Lieberman, 1999), with a particularly strong influence where school reform policies (e.g., changes in standards) are concerned (Blackmore, 1998). There is a need for further exploration of the importance of gender as a moderating principal characteristic not only in relation to school reform policies and power relations (Datnow & Castellano, 2001), but also with regard to the impact of professional development for school principals. In addition

to gender as an important consideration, years of experience, or tenure, may also be important. Researchers studying organizational changes in business have noted that employees' acceptance of change initiatives decreases with tenure (Iverson, 1996; Yousef, 2000). With regard to principals specifically, recent quantitative work offers limited evidence that years of experience as an administrator is positively associated with improved academic outcomes for students (Clark, Martorell, & Rockoff, 2009). The published work investigating the significance of principal characteristics such as gender and years of experience has not been presented in the context of experimental study, however.

Gaps in the Literature

In preparing this chapter, and following the procedure used by Camburn, Goldring, May, Supovitz, Barnes, and Spillane (2007), I conducted a review of the research literature for randomized experiments involving professional development interventions for principals. First, a search of the Campbell Collaboration Social, Psychological, Educational & Criminological Trials Register (C2-SPECTR) was conducted using the terms "principal," "leadership," and "professional development." C2-SPECTR contains more than 10,000 abstracts of randomized trials in the fields of sociology, psychology, educational, and criminology. Abstracts available in C2-SPECTR originate in one of three major bibliographic databases (the Educational Research Information Clearinghouse (ERIC), Sociological Abstracts, and Criminal Justice Abstracts), as well as forty-eight peer-reviewed journals (Petrosino, Boruch, Rounding, McDonald, & Chalmers, 2000). The search did not identify any manuscripts that focus on principals as participants with measured outcomes.

Although the importance of principals is supported in the literature, there is not a research base to draw from that would allow for the identification of detailed, specific principal practices and skills linked with student achievement. Isolating and understanding these behaviors would allow for professional development programs, as well as principal preparation programs, to be developed with an emphasis on critical skills and knowledge. For example, we believe that instructional leaders need to possess content knowledge, and research supports this (Goldwyn, 2008). However, specific content and depth of knowledge requirements for principals remains unknown; whether these requirements differ by school level (primary vs. secondary) or school type (e.g., urban, suburban, or rural) is also unknown. In addition to gaps in our knowledge of specific practices and behaviors that principals need to master, we have very limited knowledge

of what makes professional development programs successful. There are multiple calls in the literature for more rigorous studies, as many evaluations of professional development programs use participants' self-report of how well they liked the location or facility used, or how engaging the speaker was (Schmoker, 2006). It is acknowledged that we are working in an absence of an evidence-based culture in professional development evaluations (Corcoran, Fuhrman, & Belcher, 2001) with little alignment between professional development programs and participants' academic goals. There is a need in the evidence base for more testing of theories regarding these dimensions of principal professional development, as well as studies allowing for causal claims.

The review of the literature offered here highlights the need for experimental studies focused on principals. In addition, experimental studies of professional development impacts on principal participants are lacking. The research base offers little guidance on intensity, delivery format, dosage, or content for effective principal professional development interventions. Additionally, any associations between principal characteristics and professional development intervention impacts are unreported in the literature.

CHAPTER THREE

METHODOLOGY

The purpose of this study is to contribute to the current knowledge base around professional development for school principals by reporting results of an experimental investigation of professional development impacts on principals' attitudes toward leading the adoption and implementation of new mathematics and science standards. In addition to the examination of intervention effects for the sake of causal description, this study seeks to offer some causal explanation via analysis of principal characteristics as potential moderators of the intervention. This chapter outlines the research questions, conceptual framework, study design, intervention, sample, measures, data collection procedures, and proposed analytic strategy.

Research Questions

Formally, the research questions shaping this study are:

1. Did opportunity for participation, or assignment to treatment, in LMSI professional development impact principals' attitudes toward leading the implementation of Florida's NGSSS?
2. Did participation in LMSI professional development impact principals' attitudes toward leading the implementation of Florida's NGSSS?
3. Are principal characteristics, such as years of experience, gender, or area of certification, associated with the impact of LMSI professional development on principals' attitudes toward leading the implementation of Florida's NGSSS?

It is hypothesized that (a) opportunity to participate in the LMSI professional development will impact principals' measured stage of concern regarding implementation of the new standards, (b) actual participation in the LMSI professional development will be associated with principals' measured stage of concern regarding implementation of the new standards, and (c) principal characteristics will be associated with the impact of LMSI professional development.

Policy Description

As part of a statewide Math and Science Partnership (MSP), Florida PROMiSE (Partnership to Rejuvenate & Optimize Mathematics and Science Education,

www.flpromise.org) was designed to prepare Florida's educators to make changes in mathematics and science instruction aligned with the NGSSS. One component of PROMiSE, the LMSI project, aimed to provide principals with professional development focused on mathematics and science content knowledge, knowledge of the new standards, deeper understanding of effective instructional strategies, and leading learning communities as a strategy to build capacity to support teachers' adoption of reform-oriented instruction, as reflected in Florida's new content standards (Lang et al., 2010). Both the broader policy, driven by the state's adoption of the new mathematics and science standards, and the LMSI project, are arguably aimed at excellence (Green, 1983). Through the adoption of rigorous standards, professional development for educators, and a call to adopt reform-oriented mathematics instruction, Florida's policymakers intended to raise student performance in mathematics and science.

Several classes of policy instruments are involved in this process (McDonnell & Elmore, 1991). First, the adoption of the NGSSS makes use of a statewide mandate. Public schools are expected to comply with the new standards, and the desired outcome is improved teaching and learning for Florida's students. The LMSI component of the policy initiative utilizes a capacity-building instrumental approach by offering instruction to principals. This immediate benefit to the LMSI participants was designed to transfer to their schools and the students attending them, with a more distal benefit to the state via improved student performance. Florida PROMiSE also involved system-changing mechanisms by way of the competitive process through which public universities across the state sought to control some component of the MSP initiative. For example, Florida State University successfully gained oversight and implementation of the leadership training component and the University of South Florida oversaw teacher training. Authority over these different subsections of the policy shaped both the content and process of knowledge delivery to Florida's educators.

As previously noted, this dissertation is part of a broader study aimed at facilitating implementation and adoption of the NGSSS, with the distal goal of improved student performance on state assessments (e.g., FCAT Mathematics and Science). The study reported here is situated in the context of the current landscape of educational research; there is a lack of available evidence on professional development interventions for school principals, and the professional development for principals in the LMSI study was built around what we know about

effective professional development for teachers. The primary outcome of interest in this study was principals' readiness to lead the adoption and implementation of the NGSSS in their schools. As operationalized, principals' readiness to lead implementation included principals': attitudes toward, knowledge of, and support for the new standards; knowledge of resources that may be needed to facilitate implementation; and knowledge of how changes in teacher practice might be supported and encouraged. According to the LMSI theory of change, which is based on available theory and evidence, content-focused professional development aimed at developing principals' will and capacity to lead the adoption and implementation of the NGSSS in their schools would result in improved teacher practice, and ultimately, student outcomes. The data and analyses reported in this dissertation focus on the hypothesized links presented in the logic model (Table 12, Appendix A).

Methodology

Intervention

To develop principal capacity to support teachers in the adoption and implementation of new mathematics and science standards, principals were offered face-to-face learning opportunities spaced over the course of one calendar year. In addition, applied, follow-up activities between sessions were expected. Together, these professional development activities aimed to improve elementary school principals' (a) mathematics content knowledge required for teaching elementary mathematics; (b) science content knowledge and skill in applying mathematics in the context of science; (c) knowledge of the new state mathematics and science standards and benchmarks; (d) expertise in observing mathematics instruction and providing knowledgeable feedback to teachers; and (e) knowledge and skills needed to implement and sustain communities of instructional practice (CIP) focused on mathematics and science teaching and learning in their schools. Principals spent approximately 20% of their time working on each of the five aforementioned learning goals during the face-to-face professional development sessions. The applied, follow-up activities included: teaching a mathematics lesson in their school, exploring the standards database via a "scavenger hunt," work on CIP planning, and reading materials on mathematics and science teaching and learning. The LMSI professional development was designed to impact principals' readiness to lead the adoption and implementation of the new math and science standards via building not only principals' will to lead implementation (i.e., support for the new standards, prioritization of resources, and

facilitation of teacher change in practice) but also their capacity to lead implementation (i.e., improved content knowledge, knowledge of the standards, expertise in observation and feedback for teachers, and knowledge of communities of instructional practice).

During content-focused time in the face-to-face sessions, school leaders engaged in activities from various perspectives. Facilitators taught mathematics and science lessons while school leaders participated as active learners of content. To develop their skills as teacher supervisors and coaches, principals observed and discussed videos of classroom instruction, looking for evidence of student conceptions and misconceptions, cognitive complexity of student tasks, teacher-student interactions, and student-to-student interactions. The activities between sessions engaged principals as active learners as they implemented the activities from the LMSI PD within their schools and used these experiences to encourage lesson study in their schools' communities of instructional practice.

Four face-to-face, two-day sessions (nine hours per day) were spaced throughout one year to allow school leaders adequate time to plan and implement lessons learned in face-to-face workshops, complete application/implementation activities related to the sessions, and participate in group problem solving through reflection on subsequent experiences. Participants spent approximately 70% of the time in sessions engaged in mathematics and science activities focused on deepening their mathematics and science content knowledge and 30% of the time in discussions and activities that focus on how school leaders can assess and improve the quality of mathematics education occurring at their schools.

The application and implementation activities between sessions also engaged leaders as active learners as they implemented the activities from the LMSI PD within their schools (e.g., videotaping themselves teaching a lesson) and used these experiences to encourage lesson study in their schools' communities of instructional practice. These experiences were intended to help principals gain an appreciation for the depth of mathematics signaled by the curriculum standards and engage with the content both in face-to-face settings as well as in their own schools. Between each of the four sessions, participants were expected to complete assignments including approximately seven hours of reading plus two hours of online discussion related to the readings, and at least five hours of data gathering (teacher, student, and school data) for a total of approximately 40 hours of learning/application/implementation activities between sessions.

The application and implementation activities are consistent with effective school leadership, including observing mathematics classroom instruction and providing meaningful feedback to teachers, developing the school improvement plan targeting activities and outcomes related to the adoption of the new standards and improved student performance, scheduling faculty time for individual and collaborative planning and professional development, negotiating teachers' individual professional development plan activities and outcomes in light of school-specific student performance outcomes related to mathematics, leading monthly meetings with representatives from each small learning community, participating in CIP meetings, and teaching mathematics lessons.

The LMSI PD differed from more traditional professional development for principals in a number of ways. First, it was subject-specific and focused on the mathematics and science content in the state curriculum standards. The new, more challenging mathematics and science standards (NGSSS) were adopted and initially implemented in 2009, the year of the LMSI study. The NGSSS were developed with goals of: (a) more coherence (i.e., better logical progression of topics and complexity); (b) less overlap of topics and more depth at each topic; (c) increase in cognitive complexity; and (d) improved clarity of expectations. The new standards provided the context in which elementary principals could emphasize improved mathematics and science instruction as a top priority for teachers.

Instead of the one-shot training model, the LMSI PD utilized an intensive approach to professional development to build principals' capacity to encourage teacher collaboration in CIPs as they worked toward adoption of reform-oriented instruction. Principals *learned by doing* or engaged in activities that related to their daily work in order to maximize their success in applying new knowledge as they provided leadership and support in the implementation of the new standards at their respective schools. Further, the LMSI professional development was designed to align with what is known about effective dosage levels for professional development. Without evidence on this topic as it relates to principals, we relied on the available evidence on teacher professional development, and generalized to principals as instructional leaders. Specifically, a recent meta-analysis conducted by Scher & O'Reilly (2009) reported that the optimal duration (i.e., intensity, dosage, or span) for measurable changes in teachers' performance and student achievement in mathematics and science was one year to two years. A positive relation between hours spent in professional development activities and reform-oriented

changes in teachers' instructional practices have been demonstrated for both mathematics and science content areas (Boyd, Banilower, Pasley & Weiss, 2003).

Comparison Condition

Although the counterfactual varied across schools and districts, most principals in the comparison group did not expect to participate in any professional development related to improved mathematics and science instruction. Of those that did, the professional development was expected to be short in duration (one or two days) and limited in scope (focus on surface-level changes in the content of the standards rather than the mathematics knowledge or teaching and leadership strategies required to implement them). This description of the comparison group represents the findings from an online survey, conducted by FCR-STEM in June 2009 with a sample of elementary principals from throughout the state who were part of the comparison group. A clear majority (73%) of the 107 respondents indicated that they were unaware of any training on the new standards in mathematics, other than the LMSI PD, offered by the state, their districts or educational consortia, to school leaders.

Participants

Recruitment. Principals were recruited for the LMSI study through a two-step process: First, principals were invited to register to receive the LMSI PD; second, registered principals (other than the first 50, explained below) were randomly assigned to receive the PD either in 2009 or 2010 and recruited to participate in the LMSI study. Participation in the study included completion of a battery of pre- and post-measures administered January and December 2009, respectively. Eligibility to receive the PD was not contingent on the principals' consent to participate in the study. When recruitment began spring 2008, there were $n = 2266$ eligible elementary and combination elementary/secondary school principals in 74 Florida school districts.

In spring of 2008, all public elementary principals in Florida were invited to participate in the professional development funded by the Florida Department of Education through Florida PROMiSE. Registered principals, in turn, were invited, by mail and email, to participate in the LMSI study. To enlist their help in recruitment, letters were also emailed to all district school superintendents, district staff development leaders and district mathematics and science coordinators. The first $n = 50$ principals to register were enlisted in a pilot cohort, with PD that commenced in May 2008 and concluded in June 2009. The pilot study was used to understand

how best to deliver professional development to principals statewide, and which components of the professional development program were most promising. The next n = 350 principals to register were randomly assigned in August 2008 to either the LMSI 2009 group or the waitlist control group. PD for the LMSI 2009 group spanned January through December of 2009. The waitlist control group received the LMSI PD the following year, spanning April through September of 2010.

Randomization procedure. The randomization procedure for the n = 350 principals was as follows. Using the Microsoft Excel RANDBETWEEN function, each principal was assigned a random number between 0 and 1. The random numbers were then sorted in ascending order and grouped in cohorts of 50. The first four cohorts comprised the LMSI 2009 group and the last three cohorts comprised the waitlist control group, resulting in n = 200 treatment principals and n = 150 waitlist control principals.

Treatment crossover. LMSI PD was delivered in various locations across the state to cohorts as assigned by the randomization procedure. Allowances were made, as necessary (due to schedule conflicts), for principals to convene with different cohorts than assigned; however, all accommodations were made among cohorts of the same condition. For those principals assigned to the comparison condition, pre- and posttest administration was conducted on site, face-to-face, at various locations around the state. Testing locations were chosen to maximize attendance during testing days and minimize travel requirements for comparison group principals. This arrangement allowed for the same testing conditions (i.e., face-to-face, on site) for both groups of study participants.

In the LMSI project, no principals assigned to the waitlist control condition attended any of the 2009 PD sessions. However, 67 (33.5%) of the principals assigned to the treatment condition did not attend any 2009 PD sessions. Of the 133 principals who attended at least one 2009 PD session, 84 (63.2%) consented to participate in the study and completed some if not all measures. Nine of the 133 (6.7%) withdrew from the study and stopped attending PD sessions midway through 2009 (one of the nine changed to a high school in SY 2009-10, two of the nine left the principalship SY 2010-11). Otherwise, attendance among the remaining 124 LMSI 2009 PD attendees was high. Absences occurred minimally, with the mean contact hours (M = 58) for all 133 PD attendees equivalent to three and a half of the four 2-day sessions. Table 2 displays

descriptive statistics for the number of PD hours completed. Panes are presented for all treatment principals and for those who attended at least one PD session.

Table 1.
Descriptive Statistics for PD Hour Completion Among Treatment Principals

PD Completed	Min	Max	*M*	*SD*
All treatment principals (n = 200)				
Contact hours	0	64	38.63	29.32
Homework hours[a]	0	12	6.94	5.61
Total hours	0	76	45.58	34.87
Treatment principals who attended at least one PD session (n = 133)				
Contact hours	16	64	58.10	12.53
Homework hours[a]	0	12	10.44	3.26
Total hours	16	76	68.53	15.75

Note. PD = LMSI 2009 professional development.
[a]Included applied, follow-up activities between sessions.

Attrition. As described by Shadish, Cook, and Campbell (2002) the benefits of randomization and the threats associated with attrition are as follows:

> Many of the benefits of random assignment occur because it creates equivalence of groups on expectations at pretest, an equivalence that is presumed to carry over to posttest. But when attrition is present, that equivalence may not carry over, particularly because attrition can rarely be assumed to be random with respect to outcome. . . . If different kinds of people remain to be measured in one condition versus another, then such differences could produce posttest outcome differences even in the absence of treatment. (pp. 323, 59)

Moreover, attrition may reduce the comparability between groups, assumed to be achieved through randomization. Most problematic is when missingness in the data can be characterized as treatment-correlated attrition. In the remainder of this section, I will discuss the distinction between treatment attrition and measurement attrition, report the calculated overall and differential attrition rates for the LMSI sample, report analyses of the pattern of missingness, report analyses of baseline equivalence, and discuss implications on the causal validity of ensuing results.

Distinction between treatment attrition and measurement attrition. According to the *What Works Clearinghouse Procedures and Standards Handbook* (Institute of Education Sciences, 2013), "Attrition occurs when an outcome variable is not available for all participants initially assigned to the intervention and comparison groups" (p. 11). This kind of attrition is what Shadish et al. (2002) classified as measurement attrition, to be distinct from treatment attrition. As defined by Shadish et al., treatment attrition is the "Failure of units to receive treatment (whether or not they are measured)" (p. 512) and measurement attrition is the "Failure to obtain measures on units (whether or not they are treated)" (p. 509). To illustrate using the LMSI sample, 133 of the principals assigned to receive treatment in 2009 attended LMSI 2009 PD sessions. The 67 principals assigned to treatment who did not attend any PD sessions are considered treatment attriters; and although 15 of them consented to participate in the study, all but two were also measurement attriters because they did not complete both pre- and post-measures of the outcome measure (CFSoCQ). Of the 133 principals assigned to receive treatment in 2009 that attended LMSI 2009 PD sessions, only 84 consented to participate in the study. The 49 principals—who attended the PD but did not consent to participate in the study—are not treatment attriters but are considered measurement attriters.

Two related, yet distinct, aims of the LMSI project were to 1) provide PD designed to support the adoption and implementation of the NGSSS in Mathematics and Science and 2) investigate the impact of the PD on principals and their schools. The investigation undertaken in the current study is aligned with the second aim of LMSI project; thus, throughout this dissertation the term *attrition* pertains to what the WWC associates with attrition: measurement attrition. Thus, although it is the case that some instances of treatment attrition co-occur with measurement attrition, calculations of attrition in the current study are based on measurement attrition, irrespective of treatment attrition. Therefore, reported attrition should not be interpreted

as a reflection of the LMSI project's accomplishment of its first aim of providing PD. Rather, the reporting of attrition rates pertains to the project's second aim of investigating the impact of the PD.

Attrition rates. Principals recruited to receive LMSI PD (either in 2009, i.e., the Treatment group, or in 2010, i.e., the Waitlist Control group) were invited to participate in the LMSI research study, which included a battery of pre- and post-measures. Pretesting occurred January 2009; post-testing occurred December. Of the 350 eligible principals, 178 (50.9%) principals consented to participate in the study: 99 (49.5%) of the treatment principals and 79 (52.7%) of the control principals. Both pre- and post-test CFSoCQ data were collected on 119 participants: 69 (34.5%) of the treatment principals and 50 (33.3%) of the control principals. Overall and differential attrition calculated from these values indicate an overall rate of 66% and differential rate of 1.2%.

For measures that are context dependent—such as the Change Facilitators Stage of Concern Questionnaire (CFSoCQ)—data from principals that changed schools between completing pre- and post-testing may have questionable validity. If only principals who remained in the same school throughout the intervention period are considered, both pre- and post-CFSoCQ data were collected on 110 participants: 63 (31.5%) of the treatment principals and 47 (31.3%) of the control principals. Thus, for data that are not independent from the context of the school site on which the principal is reporting against, attrition calculated from these latter values indicate an overall rate of 68.6% and differential rate of 0.2%.

Figure 1 displays a participant flow chart illustrating the reduction of sample size from the initial sample of registered principals to the final analytic sample. The flowchart disaggregates the sample by treatment condition and further disaggregates the treatment group by whether they did or did not attend the LMSI PD. Presented reduction in sample size is based on the sequential filtering by (a) whether the principal consented to participate in the study, (b) completed both pre-and post-measures, and (c) remained in the same school during SY 2008-09 and 2009-10. Although consent to participate in the study preceded the onset of PD delivery, sample *n*s for attend/did not attend PD are presented first in the flow chart to better convey that the sample of consenting principals was a subset of those who did or did not attend the PD.

Pattern of missingness. Principal mobility was prevalent with the sample. Across the four years (SY 2007-08 to SY 2010-11) of the LMSI project, 79 (22.6%) of the 350 participating

principals changed schools at least once and 52 (14.9%) left the principalship. The LMSI 2009 PD spanned two academic years (SY 2008-09 to SY 2009-10): 165 (82.7%) of the treatment principals were in the same school for both years; 124 (82.5%) of the control principals were in the same school for both years. Table 2 displays the cross-tabulation of treatment condition with being at the same school SY 2008-09 and SY 2009-10 (mid-intervention interruptions include changing school and leaving the principalship). Included in the table are statistics for the Pearson Chi-Square and Likelihood Ratio tests. Neither test rejects the assumption of the pattern of frequencies being to be due to chance, suggesting no detectable difference in principal mobility between conditions.

Table 2
Cross-tabulation of Treatment Condition with Being at the Same School SY 2008-09 and 2009-10

		At the same school SY 2008-09 and SY 2009-10			Pearson χ^{2b}		Likelihood ratio	
Treatment condition		No[a]	Yes	Total	Value (*df*)	*p*	Value (*df*)	*p*
Treatment	Count	35	165	200				
	(%)	(17.5%)	(82.5%)	(100%)				
Waitlist control	Count	26	124	150				
	(%)	(17.3%)	(82.7%)	(100%)				
Total	Count	61	289	350	.002 (1)	.968	.000 (1)	.968
	(%)	(17.4%)	(82.6%)	(100%)				

Note. SY = School year.
[a]Counts include participants who changed from one school to another and those who left the principalship.
[b]Zero cells (0.0%) have expected count less than 5.

Table 3 displays the cross-tabulation of being at the same school SY 2008-09 and SY 2009-10 with principal completion of both pre- and post-tests. Panes are presented for the total sample, as well as for the treatment and control group separately. Included in the table are statistics for the Pearson Chi-Square and Likelihood Ratio tests. Both the Pearson Chi-Square and Likelihood Ratio tests reject the assumption of the pattern of frequencies being to be due to chance, suggesting a positive relation between principal mobility and measurement attrition. Statistically significant values were found for the sample as a whole and disaggregated by

condition. As previously mentioned, testing conditions were designed to be similar for both study groups (i.e., PD attendees and comparison group) in order to eliminate any bias associated with testing format and administration.

Table 3
Cross-tabulation of Being at the Same School SY 2008-09 and SY 2009-10 with Having Completed Both Pre- and Post-test CFSoCQ

		Has pre- and post-test data			Pearson χ^{2b}		Likelihood ratio	
At the same school SY 2008-09 and SY 2009-10		No	Yes	Total	Value (*df*)	*p*	Value (*df*)	*p*
Total sample (*N* = 350)								
No[a]	Count	52	9	61				
	(%)	(85.2%)	(14.8%)	(100%)				
Yes	Count	179	110	289				
	(%)	(61.9%)	(38.1%)	(100%)				
Total	Count	231	119	350	12.19 (1)	.000	13.67 (1)	.000
	(%)	(66.0%)	(34.0%)	(100%)				
Treatment principals (*n* = 200)								
No[a]	Count	29	6	35				
	(%)	(82.9%)	(17.1%)	(100%)				
Yes	Count	102	63	165				
	(%)	(61.8%)	(38.2%)	(100%)				
Total	Count	131	69	200	5.66 (1)	.017	6.22 (1)	.013
	(%)	(65.5%)	(34.5%)	100%				
Control principals (*n* = 150)								
No[a]	Count	23	3	26				
	(%)	(88.5%)	(11.3%)	100%				
Yes	Count	77	47	124				
	(%)	(62.1%)	(37.9%)	100%				
Total	Count	100	50	150	6.72 (1)	.010	7.79 (1)	.005
	(%)	(66.7%)	(33.3%)	100%				

Note. SY = School year.
[a]Counts include participants who changed from one school to another and those who left the principalship.
[b]Zero cells (0.0%) have expected count less than 5.

Baseline equivalence. According to What Works Clearinghouse (WWC; Institute of Education Sciences, 2013) standards, meeting equivalence requirements is a key determinant of whether a study *Meets WWC Group Design Standards Without Reservations*, *Meets WWC Group Design Standards With Reservations*, or *Does Not Meet WWC Group Design Standards*. Using pretest CFSoCQ data, Table 4 displays the cross-tabulation of pretest CFSoCQ highest stage of concern with treatment condition, including a test of column proportion comparisons using Bonferroni adjusted *p*-values. Table 5 displays the Chi-Square tests of significance. Limitations to these results include the conservative nature of the Bonferroni correction as well as the number of expected frequencies with low counts (eight of the 12 cells had expected counts less than 5). To address the limitation associated with low expected frequencies, Fisher's exact test (Field, 2005) was computed. All tests were non-significant, indicating there were no detectable differences in the column proportions. Limitations notwithstanding, these results suggest baseline equivalence may be assumed between treatment and control group participants on the CFSoCQ.

Attrition implications. Analyses of attrition for this study show an overall rate of 68.6% and a differential rate of 0.2%. There are several considerations regarding these results. First, for the sample as a whole as well as disaggregated by condition, analyses indicate a statistically significant positive relation between principal mobility and attrition (see Table 3). Thus, the pattern of missing observations could be characterized by principal mobility. Second, the low differential attrition rate further demonstrates that missingness is not systematically associated with condition. Moreover, there is evidence that much of the attrition is exogenous, suggesting the appropriateness of more optimistic assumptions regarding the relation between attrition and the outcome. Accordingly, these data satisfy the assumption of *Missing at Random* (Rubin, 1976); indicating, the process that potentially produced missing data can be reasonably ignored. Citing Little and Rubin (1987), Shadish et al. (2002) note that *ignorability* implies that, using likelihood-based inference, "unbiased estimates of treatment effectiveness can be obtained" (p. 337). Third, the demonstration of baseline equivalence (see Tables 4 and 5) between treatment and waitlist control participants on the measure of interest further supports the internal, or causal, validity of findings from this study.

Table 4
Cross-tabulation of CFSoCQ Pretest Highest Stage of Concern with Treatment Condition

Stage		Condition		Total
		Treatment	Control	
0	Count	35_a	29_a	64
	Expected count	39.1	24.9	64
	% within highest stage	54.7%	45.3%	100%
	% within condition	37.2%	48.3%	41.6%
1	Count	44_a	28_a	72
	Expected count	43.9	28.1	72
	% within highest stage	61.1%	38.9%	100%
	% within condition	46.8%	46.7%	46.8%
2	Count	1_a	0_a	1
	Expected count	0.6	0.4	1.0
	% within highest stage	100%	0.0	100%
	% within condition	1.1%	0.0%	0.6%
3	Count	6_a	2_a	8_a
	Expected count	4.9	3.1	8
	% within highest stage	75.0%	25.0%	100%
3	% within condition	6.4%	3.3%	5.2%
4	Count	4_a	1_a	5
	Expected count	3.1	1.9	5.0
	% within highest stage	80.0%	20.0%	100%
	% within condition	4.3%	1.7%	3.2%
5	Count	4_a	0_a	4
	Expected count	2.4	1.6	4.0
	% within highest stage	100%	0.0%	100%
	% within condition	4.3%	0.0%	2.6%
Total	Count	94	60	154
	Expected count	94.0	60.0	154.0
	% within highest stage	61.0%	39.0%	100.%
	% within condition	100%	100%	100%

Note. n = 154 cases. Each subscript ($_a$) denotes a subset of Condition 2009 categories whose column proportions do not differ significantly from each other at the .05 level, according to the z-test (Bonferroni method) correction for multiple comparisons.

Table 5
Chi-Square Tests of Significance for Pretest CFSoCQ

Test	Value	*df*	*p*	
			Asymptotic (2-sided)	Exact (2-sided)
Pearson chi-square[a]	5.69	5	.338	.331
Likelihood ratio	7.53	5	.184	.247
Fisher's exact test[b]	5.02			.396

Note. n = 154 cases.
[a]Eight cells (66.7%) have expected count less than 5. The minimum expected count is .39.
[b]The standardized statistic is 2.254.

WWC (Institute of Education Sciences, 2013) guidelines on attrition indicate that a "Sample that is lost after initial assignment but for reasons that are independent of group assignment may be excluded from the initial sample for attrition calculations. For example, it would be acceptable to exclude from attrition calculations a school that closed due to a hurricane" (pp. 11-12). Thus, given our ability to (a) characterize attrition with mobility, (b) find no evidence of a correlation between attrition and treatment, and (c) meet requirements for baseline equivalence, the denominator in my attrition calculation might be modified to exclude principals who were not at the same school SY 2008-09 and SY 2009-10. Under this proposal, the new starting sample sizes would be as follows: total sample $n = 289$ (out of $n = 350$); treatment $n = 165$ (out of $n = 200$); waitlist control $n = 124$ (out of $n = 150$). Calculated rates of attrition would change from an overall rate of 68.6% to 61.9% and from a differential rate of 0.2% to 0.3%. The WWC guidelines on the combination of overall and differential attrition rates that generate what the WWC considers to be low, moderate, and high attrition, do not go any higher than an overall rate of 57% attrition. Thus, the improvement in the attrition rate achieved through a liberal conceptualization (that excludes mobile principals from the attrition calculation) does not improve the attrition rate enough to move it into a moderate or low attrition classification. Moreover, there is nothing to be gained by using anything other than the conservative calculation. Hence, although there are supports for applying optimistic assumptions, according to the WWC standards the threat of potential bias persists due to the high overall rate of attrition. Accordingly, the joint consideration of the rate of attrition and the meeting of equivalence requirements confers that this study *Meets WWC Group Design Standards With Reservations*: indicating, there are limitations to the causal validity of the findings; limitations that would not be assumed for a randomized experiment with low to moderate attrition.

In light of these considerations, study findings may be more appropriately interpreted with the limitation attributed to a quasi-experimental design with baseline equivalence. Nevertheless, Shadish et al. (2002) assert that it is not the case that "randomized experiments with attrition are no better than quasi-experiments" (p. 324). Shadish et al. continue, noting,

> After all, these same attrition biases may exist in quasi-experiments, adding attrition bias to the selection bias already present in the design. Meta-analytic evidence suggests that effect sizes from randomized experiments with attrition fall between those from randomized experiments with no attrition and quasi-experiments (Shadish & Ragsdale,

1996). It is likely, therefore, that initial randomization can often reduce the overall magnitude of posttest bias when compared with quasi-experimental approaches, even when attrition occurs. (p. 324)

Measures

Dependent Variable

Principal attitudes toward implementation of the new standards. The Change Facilitators Stages of Concern Questionnaire (CFSoCQ; Hall, Newlove, George, Rutherford & Hord, 1991) was used to measure principals' concerns about change as the new content standards are implemented at their respective schools. Respondents rated 35 items on a 0 to 6 point Likert scale rating how each item described their concerns at that point in time. The CFSoCQ is based on the Concerns Based Adoption Model (CBAM; Hall, George, & Rutherford, 1979) developed to measure the level of adoption of educational practices and programs. Researchers of the CBAM developed the CFSoCQ following the development and widespread use of the original Stages of Concern Questionnaire (Hall et al., 1991), designed to assess the concerns of front-line users of innovations. The CFSoCQ has been used in experimental research focused on professional development outcomes (e.g., Lang et al., 2006). The CFSoCQ has satisfactory psychometric properties, with the developers reporting alpha coefficients ranging from .64 to .83 and test/retest reliabilities ranging from .65 to .86 (Hall et al., 1991). Both pre- and posttest reliabilities (Cronbach's and ordinal alphas) for the current sample are presented in Table 7; posttest ordinal alphas (Zumbo, Gadermann, & Zeisser, 2007) range from .54 to .82.

The CFSoCQ items measure respondents' current attitudes, feelings, and concerns about leadership of an innovation, or change. There are five items each for seven stages of concern. The instrument developers describe concern as "the composite representation of the feelings, preoccupation, thought, and consideration given to an issue or task" (Hall, George, & Rutherford, 1979, p.5). Detailed descriptions for each of the stages of concern about leadership of an innovation are presented in Table 6; the seven stages are classified into one of three domains: self, task, and impact. Although the stages may appear to be developmental and predictably progressive, the developers of the CFSoCQ caution that a linear trajectory of "stage development" is not to be expected for all successful change initiatives. The items representing the last stage, Refocusing, provide some clarity on the question of stage progression.

Specifically, if successful implementation is the goal, then high percentages of respondents reporting stage six (Refocusing) as their highest stage of concern might be worrisome given that this stage represents participants who may not prioritize the innovation being investigated (i.e., NGSSS implementation activities). These respondents may be considering alternative approaches to support teaching and learning; they may be more concerned with another change initiative altogether.

The CFSoCQ aligns with the primary outcome of interest, principal readiness to lead the adoption and implementation of the NGSSS, by measuring principals': (a) support for the new standards; (b) desire to learn about the standards; (c) concerns and doubts about being able to lead the adoption and implementation of the NGSSS; (d) interest in resource allocation aimed at implementation efforts; (e) interest in becoming a better change facilitator; (f) greater focus on other tasks and/or priorities; and (g) considerations of new innovations that would increase the effects of teaching and learning the new standards. The primary domains captured in the measure, self, task, and impact, reflect important domains in readiness to lead implementation. Moreover, the seven stages reflect specific areas of concern, or lack of concern, around implementation.

The CFSoCQ maps onto the professional development activities offered in the LMSI intervention by measuring principals' self-report on stages of concern that are consonant with several of the LMSI outputs (see Logic Model, Table 12, Appendix A). First, the LMSI theory of change posits that principal participation in the professional development would lead to improved skills in observing classroom instruction and providing feedback to teachers. Several stages represented in the CFSoCQ align with this output; namely, Stage 1 (Informational), Stage 2 (Personal), Stage 3 (Management), and Stage 4 (Consequence) offer some measure of principals' perception regarding improved observation and feedback skills. Items in stage 2 (Personal) give some indication of how confident principals are in their abilities to lead the innovation. Given that this successful adoption and implementation ultimately must be made by classroom teachers, principals' improved classroom observation and teacher feedback skills may reasonably be expected to impact principals' confidence levels. Items in stage 3 (Management) measure how concerned principals are about managing the innovation (e.g., facilitating the implementation with others, finding time for CIPs and other aspects of adoption, and communication and problem-solving demands). Finally, items in stage 4 (Consequence) measure

principals' concerns around helping others (i.e., teachers) adopt and implement the new standards.

Additionally, stages 5 (Collaboration) and 6 (Refocusing) offer some insight on the expected output of revised school improvement plans (SIP) and teacher individual professional development plans (IPDP) to reflect active participation in the adoption and implementation of the NGSSS. High endorsement of stage 5 (Collaboration) items would be in alignment with the revision of SIPs and IPDPs in their school sites, while high scores for stage 6 (Refocusing) might indicate that principals have ideas about different ways of supporting teaching and learning in their schools. Finally, the CFSoCQ offers insight into principals' attitudes toward the NGSSS by asking explicitly if (a) leading the adoption and implementation of these new standards is important to them at this time, (b) the NGSSS is something they would like to learn more about, and (c) whether principals are more interested in other change initiatives. See Table 6 for descriptions of each of the stages of concern.

Reliability estimates for this sample at both pre- and posttest are presented in Table 7. Both linear and nonlinear reliability estimates were calculated, due to the fact that the CFSoCQ employs a Likert-type item response format and the data arising from this format type may not be continuous. Cronbach's alpha is routinely calculated using a Pearson covariance matrix, which involves the assumption that the data are continuous. Violations of this assumption can result in an underestimation of scale reliability. Additionally, ordinal alphas (Zumbo et al., 2007) were calculated for both pre- and posttest data with the current sample.[2] In keeping with the suggested approach when conducting statistical analyses with these data, I used the raw scores instead of percentile scores (George, Hall, & Stiegelbauer, 2006).

Independent Variable

Assignment to condition (participation in LMSI professional development vs. wait-list control conditions); assignment to condition followed the randomization procedure previously outlined.

[2] For instruments where the number of response categories is high the estimates for linear alpha and Cronbach's alpha tend to be very similar.

Table 6
Description of the Seven Stages of Concern

SELF	0	Awareness	Change facilitation in relation to the innovation is not an area of intense concern. The person's attention is focused elsewhere.
	1	Informational	There is interest in learning more about the innovation. The concern is not self-oriented or necessarily change facilitation oriented. The focus is on the need/desire to know more about the innovation, its characteristics, its use and effects.
	2	Personal	Uncertainty about one's ability and role in facilitating use of the innovation is indicated. Doubts about one's adequacy to be an effective change facilitator and questions about institutional support and rewards for doing the job are included. Lack of confidence in oneself or in the support to be received from superiors, nonusers, and users are part of this stage.
TASK	3	Management	The time, logistics, available resources, and energy involved in facilitating others in use of the innovation are the focus. Attention is on the "how to do its" of change facilitation, decreasing the difficulty of managing the change process, and the potential of overloading staff.
	4	Consequence	Attention is on improving one's own style of change facilitation and increasing positive innovation effects. Increasing the effectiveness of users and analyzing the effects on clients are the focuses. Expanding his/her facility and style for facilitating change is also the focus.
IMPACT	5	Collaboration	Coordinating with other change facilitators and/or administrators to increase one's capacity in facilitating use of the innovation is the focus. Improving coordination and communication for increased effectiveness of the innovation are the focuses. Issues related to involving other leaders in support of and facilitating use of the innovation for increased impact are indicated.
	6	Refocusing	Ideas about alternatives to the innovation are a focus. Thoughts and opinions oriented towards increasing benefits to clients are based on substantive questions about the maximum effectiveness of the present innovative thrust. Thought is being given to alternative forms or possible replacement of the innovation.

Covariates

LMSI general survey. The LMSI general survey was developed by the LMSI research team, and used to gather both demographic information and participant feedback on their understanding and exposure to the NGSSS (e.g., any other professional development opportunities related to the NGSSS). Potential covariates include:

1. Years of experience as a principal
2. Years of experience as an assistant principal
3. Total years of experience as an administrator – principal and assistant principal combined
4. Years of experience as a teacher
5. Total years of experience as an educator/administrator
6. Gender
7. Areas of certification

Table 7
Reliability Coefficients for CFSoCQ Stages of Concern at Pre- and Posttest With Analytic Sample

	Prettest (n = 110)		Posttest (n = 110)	
Stage	Linear	Nonlinear	Linear	Nonlinear
0 Awareness	.52	.54	.57	.54
1 Informational	.78	.80	.76	.82
2 Personal	.62	.63	.68	.68
3 Management	.81	.81	.78	.78
4 Consequence	.71	.72	.73	.74
5 Collaboration	.75	.76	.76	.78
6 Refocusing	.57	.61	.62	.70

Note. Linear = Cronbach's α. Nonlinear = Ordinal α.

Analytic Strategy

Data from the LMSI study was used to examine whether assignment to professional development aimed at improving principals' mathematics and science content knowledge, knowledge of the NGSSS, and ability to support teachers' changes in practice, had an impact on participants' attitudes toward leading implementation of Florida's NGSSS. I also investigate the relation between levels of participation and principals' attitudes toward leading implementation of the new standards. Finally, principal characteristics are investigated as potential covariates and moderators.

Multinomial logistic regression (MLR) is used to analyze both pre- and post-test data on principals' attitudes toward mathematics and science reform. Logistic regression is appropriate when there are two mutually exclusive categories in the dependent variable. MLR is used when there are three or more categories in the dependent variable (Hosmer & Lemeshow, 2000). These categories may be ordered or unordered (Hosmer & Lemeshow; Long, 1997).

Whereas logistic regression is used with binary dependent variables (DVs) to compare the probability of membership in one category compared to the probability of membership in the reference category, MLR is used for DVs with more than two categories to compare the probability of a case falling into a specific category compared to the probability of membership in the reference category. Suppose a DV has M categories, and the first category is designated as the reference category. This would require the calculation of M-1 equations. Hence, for each case, there will be M-1 predicted log odds, one for each category relative to the reference category (Treiman, 2009).

For m = 1, …, M,

$$\ln\left[\frac{P(Y_i = m)}{P(Y_i = 0)}\right] = a_m + \sum_{k=1}^{K} b_{km} X_{ki} = Z_{mi}$$

Where,

$$P(Y_i = m) = \frac{\exp(Z_{mi})}{1 + \sum_{h=2}^{M} \exp(Z_{hi})}$$

And for the reference category,

$$P(Y_i = 0) = \frac{1}{1 + \sum_{h=2}^{M} \exp(Z_{hi})}$$

In other words, the MLR technique takes each of the M-1 log odds computed and exponentiates it. Accordingly, the procedure involves simultaneously estimating a set of logistic regression equations. For the seven CFSoCQ categories (Stages 0-6), the equations would be of the form,

$$\ln\left[\frac{P(Y_i = 1 \mid X_i)}{P(Y_i = 0 \mid X_i)}\right] = a_1 + \sum_{k=1}^{K} b_{k1} X_{ki}$$

$$\ln\left[\frac{P(Y_i = 2 \mid X_i)}{P(Y_i = 0 \mid X_i)}\right] = a_2 + \sum_{k=1}^{K} b_{k2} X_{ki}$$

$$\cdots$$

$$\ln\left[\frac{P(Y_i = 6 \mid X_i)}{P(Y_i = 0 \mid X_i)}\right] = a_6 + \sum_{k=1}^{K} b_{k6} X_{ki}$$

Because there is a lack of consensus in the literature on whether the CFSoCQ stages should be considered as nominal or ordinal (Cotabish & Robinson, 2012), MLR analyses are supplemented by OLS regression analyses, which treat the CFSoCQ stages as linear and ordinal for research question one. The instrument developers do address this aspect of the stages, and state "The emergence and resolution of concerns appears to be, for many innovations and processes, developmental, in that earlier concerns must first be resolved (lowered in intensity) before later concerns can emerge (increase in intensity). However, this pattern is not a certainty" (George, Hall, & Stiegelbauer, 2006, p. 8-9). Accordingly, I chose to use MLR as the analytic strategy for research questions two and three in order to accommodate this nonlinearity of the stages of concern.

The choice to treat the CFSoCQ stages as categorical, in addition to being aligned with what the instrument developer's suggest is the appropriate approach, is also advantageous for interpretive reasons. Namely, the MLR approach allows investigation of not only whether the professional development intervention was effective for impacting principals' highest stage of concern, but also provides information on what ways the intervention might impact these concerns. That is, it allows for knowing if principals are more or less likely to report one stage as a greater concern versus another stage.

MLR is a more complex modeling approach than OLS regression, and one important consideration regarding the use of MLR is that when combinations of data points result in low cell counts the model estimates may not be considered admissible due to larger-than-expected standard errors (Faddy & Smith, 2011). For this sample, the MLR approach calls for sufficient numbers of principals with various characteristics (e.g., variation in years of experience, gender, and areas of certification) and highest stage of concern; where these criteria are not met,

underdispersion may be a problem (Field, 2005). Notation will indicate where any inadmissible values are found in this study.

CHAPTER FOUR

RESULTS

Analytic Sample

The analytic sample for this work included those elementary school principals from across Florida who registered to participate in the LMSI professional development and consented to participate in the LMSI investigation of professional development impacts. Participation in the LMSI study was not a requirement for receipt of professional development. The analytic sample for each research question is the same, and includes only those principals who (a) consented to participate in research, (b) completed both pre- and posttests, and (c) did not change schools during SY 2008-09 and SY 2009-10. The final analytic sample includes 110 elementary principals, with $n = 63$ assigned to the professional development (or treatment, hereafter Tx) condition, and $n = 47$ in the business-as-usual waitlist comparison group. All analyses presented in this chapter were conducted using SPSS version 22. This chapter includes descriptive statistics for the analytic sample, results of confirmatory analyses for research question one, and results of exploratory analyses for research questions two and three.

Descriptive Statistics

Descriptive statistics are presented in two sections: frequencies for the dependent variable at both pre- and posttest, and descriptive and frequency statistics for the principal characteristic variables.

Frequencies for Dependent Variable

Figures 2 and 3 (Appendix C) and Table 8 show that at pretest Stages 0 (Awareness), 2 (Personal), and 6 (Refocusing) are not indicated as principals' highest stage of concern, with either zero (stages 0 and 6) or only one (stage 2) principal indicating this as the highest stage of concern. The majority of principals in both groups endorsed Stage 1 (Informational) as their highest stage of concern at pretest. Analysis of posttest highest CFSoCQ (Figures 4 and 5, Appendix C) and Table 9 show the majority of Tx principals indicate Stage 5 (Collaboration) as their highest stage of concern, while comparison group principals indicate Stage 1 (Informational) as their highest stage.

Table 8
Frequency Statistics for Pretest CFSoCQ Highest Stage of Concern

	Treatment		Control	
CFSoCQ pretest highest stage	*n*	%	*n*	%
Stage 0 Awareness	0	0	0	0
Stage 1 Informational	39	61.9	26	55.3
Stage 2 Personal	0	0	1	2.1
Stage 3 Management	6	9.5	4	8.5
Stage 4 Consequence	8	12.7	5	10.6
Stage 5 Collaboration	10	15.9	11	23.4
Stage 6 Refocusing	0	0	0	0
Total	63	100.0	47	100.0

Note. CFSoCQ = Change Facilitators Stages of Concern Questionnaire

Table 9
Frequency Statistics for Posttest CFSoCQ Highest Stage of Concern

	Treatment		Control	
CFSoCQ posttest highest stage	N	%	N	%
Stage 0 Awareness	3	4.8	0	0.0
Stage 1 Informational	6	9.5	17	36.2
Stage 2 Personal	0	0.0	0	0.0
Stage 3 Management	6	9.5	5	10.6
Stage 4 Consequence	15	23.8	10	21.3
Stage 5 Collaboration	33	52.4	15	31.9
Stage 6 Refocusing	0	0.0	0	0.0
Total	63	100.0	47	100.0

Note. CFSoCQ = Change Facilitators Stages of Concern Questionnaire.

Frequencies and Descriptives for Principal Characteristics Variables

As shown in Table 10, the sample was predominantly female (84.5%) certified elementary education teachers (70.9%), with Master's degree as the highest degree earned (66.4%). Principals in this sample have an average of twelve years teaching experience (*M* =

12.01, *SD* = 6.29, range = 0 to 35) and nearly three and one half years of experience as a school principal (*M* = 3.43, *SD* 1.57, range = 1 to 10).

Table 10
Descriptive Statistics for Principal Characteristic Variables for Treatment, Comparison, and Full Sample

	Treatment		Comparison		Full Sample	
Categorical variables	*n*	%	*n*	%	*N*	%
Gender						
Female	55	87.3	38	80.9	93	84.5
Male	8	12.7	9	19.1	17	15.5
Certified elementary teacher	41	65.1	37	78.7	78	70.9
Certified STEM area	2	3.2	1	2.1	3	2.7
Highest degree earned						
Master's	45	71.4	28	59.6	73	66.4
Specialist	9	14.3	11	23.4	20	18.2
Doctorate	6	9.5	6	12.8	12	10.9
	Treatment		Comparison		Full Sample	
	n(63)		*n*(47)		*N*(110)	
Continuous variables	*M*	*SD*	*M*	*SD*	*M*	*SD*
Years elementary principal	2.97	1.31	2.98	1.58	2.97	1.43
Total years principal	3.31	1.46	3.58	1.71	3.43	1.57
Years teach elementary	3.17	1.90	3.51	1.77	3.32	1.84
Years teach STEM	0.78	2.03	0.38	1.21	0.60	1.71
Total years teach	11.09	6.60	13.21	5.72	12.01	6.29
Total years experience	14.31	6.98	16.81	5.73	15.42	6.54
PD contact hours	34.89	30.73				
PD homework hours	6.36	5.74				
PD total hours	41.25	36.44				

Note: PD = professional development.

Demographic similarity of the two groups was tested for categorical indicators using chi-square tests of independence (with Yates Continuity Correction); results indicated no significant association between condition and gender, χ^2 (1, *n* = 110) = .44, *p* = .51, *phi* = .09; no significant association between condition and elementary educator certification, χ^2 (1, *n* = 110) = 1.81, *p* = .18, *phi* = -.15; no significant association between condition and educator certification χ^2 (1, *n* =

110) = .00, p = .99, *phi* = .03; and no significant association between condition and highest degree earned χ^2 (1, n = 110) = 2.06, p = .36, *phi* = .14. Independent-samples t-tests were conducted to compare groups on continuous principal characteristics variables indicating years as elementary principal, total years as principal, years elementary teacher, years as STEM teacher, and total years teaching; no significant differences in scores for Tx versus comparison principals were found for any of the characteristics variables.

Modeling Implications for Distribution of Stage of Concern at Pretest and Posttest

Stage 1 (Informational) was the most prevalent stage of concern for principals at pretest and a substantial portion of the sample was at Stage 1 at posttest. Given that no principal's highest stage of concern was Stage 0 (Awareness) at pretest and only a small portion were at Stage 0 at posttest, when stage of concern is treated as nominal, Stage 1 (Informational) is the reference category. Thus, Stage 1 is not modeled as a focal outcome in any analyses and there are no coefficients estimated for Stage 1 as a covariate. In addition, at posttest, no participant's highest stage of concern was Stage 2 (Personal) and Stage 6 (Refocusing), and therefore, neither Stage 2 nor 6 are modeled as outcomes. Moreover, when stage of concern is treated as nominal, Stages 0 (Awareness), 3 (Management), 4 (Consequence), and 5 (Collaboration) are the focal outcome categories, with Stage 1 modeled as the reference category. With regard to estimated coefficients for the pretest stages of concern, no participant's highest stage of concerns was Stages 0 or 6 at pretest, and therefore, no estimates are made for these stages as covariates.

Results for Research Question 1: Did opportunity for participation, or assignment to treatment, in LMSI professional development impact principals' attitudes toward leading the implementation of NGSSS?

Treating CFSoCQ as continuous and linear. For research question one, confirmatory analyses included first treating the outcome of interest, participants' highest stage of concern as measured by the CFSoCQ, as linear and continuous. As previously noted, there is lack of agreement in the research community around the linearity of the seven stages captured by the CFSoCQ; in pursuit of transparency and thoroughness, separate analyses are reported here, one treating the CFSoCQ stages as continuous and another as nominal.

As shown in Table 11, multiple regression analyses indicate that treatment had a statistically significant and positive impact on participants' self-reported highest stage of concern at posttest (β = .83, p = .01); these results held after controlling for pretest CFSoCQ status (β =

.89, p = .00). For calculation of effect sizes associated with categorical independent variables (i.e., treatment condition), I used a Hedges' g weighted pooled standard deviation in the denominator to calculate unbiased mean group differences. For effect sizes associated with continuous independent variables (i.e., pretest score in the multiple regression analyses), I used a partial eta squared correlation ratio to estimate the proportion of variance in posttest explained by pretest, after excluding variance explained by other predictors. In Model 2 (controlling for pretest), the estimated effect size was g = .56, indicating a greater than a half-standard deviation difference between conditions at posttest.

Table 11
Confirmatory Analyses Estimates for CFSoCQ Treated as Continuous and Linear

	Model 1			Model 2			
	β	SE	*p*	β	SE	*p*	*ES*
Constant	3.13	.23	.00	2.43	.31	.00	
Treatment	.83	.31	.01	.89	.30	.00	.56
Pretest	—	—	—	.28	.09	.00	.09

Note. Model 1 is Treatment status predicting posttest CFSoCQ. Model 2 is Treatment status predicting posttest CFSoCQ, controlling for pretest CFSoCQ.

Treating CFSoCQ as nominal. Although there is lack of agreement among researchers and practitioners as to whether these stages should be conceptualized and analyzed as linear, the instrument developers maintain that the stages of concern are to be viewed as nonlinear, and movement between stages might be expected to follow nonlinear trends (Hall et al., 1991). Accordingly, I chose multinomial logistic regression (MLR) as the primary analytic approach for these analyses.

It is noted that in all tables, where low cell counts (i.e., not enough data points available) result in numerical instability a dash is inserted to distinguish these cells from empty cells due to non-applicable data points. Moreover, for all MLR analyses, the reference category is Stage 1 (Informational). This was chosen for both theoretical and empirical reasons; first, as noted above regarding modeling implications for the distribution of stages of concern, at pretest the majority of principals endorsed Stage 1 (Informational) as their highest stage of concern and no principals endorsed Stage 0 (Awareness) as their highest stage of concern. Further, one of the primary aims of the LMSI professional development involved providing participants with information related

to the standards and their implementation. If Tx operated according to theory, then we would expect to see change in participants' status related to Stage 1 (Informational) as compared to principals in the comparison group.

Results of confirmatory analyses for research question one suggest that for principals assigned to Tx the estimated odds of endorsing Stage 3 (Management) were nearly four times higher (odds ratio = 3.9) than principals in the comparison group, the estimated odds of endorsing Stage 4 (Consequence) were more than six times higher (odds ratio = 6.10) than for principals in the comparison group and the estimated odds of endorsing Stage 5 (Collaboration) as the highest stage of concern were nearly nine times higher (odds ratio = 8.9) than for principals in the comparison group; these results were obtained from Model 2 (Table 13, Appendix D), controlling for pretest CFSoCQ. There was not a statistically significant difference in estimated odds of endorsing Stage 0 (Awareness) versus Stage 1 (Informational) between Tx and comparison group principals.

Results for Research Question 2: Did participation in LMSI professional development influence principals' attitudes toward leading the implementation of NGSSS?

Results of exploratory analyses for research question two (Table 14, Appendix D) suggest that for principals who attended the LMSI professional development, the estimated odds of endorsing Stage 3 (Management) versus Stage 1 (Informational) were 2% higher for each hour of professional development attended (odds ratio = 1.02), the estimated odds of endorsing Stage 4 (Consequence) were 3% higher for each hour of professional development attended (odds ratio = 1.03) and the estimated odds of endorsing Stage 5 (Collaboration) as the highest stage of concern were 4% higher for each hour of professional development attended (odds ratio = 1.04); these results were obtained from Model 2, controlling for pretest CFSoCQ. There was not a statistically significant difference in estimated odds of endorsing Stage 0 (Awareness) for hours of professional development attended. Given that each two day training session involved nine hours per day, these results indicate that for each session attended (18 hours), the estimated odds of endorsing: Stage 3 (Management) were 36% higher, Stage 4 (Consequence) were 54% higher, and Stage 5 (Collaboration) were 72% higher as compared to endorsing Stage 1 (Informational). It is noted that Tx is not entered into either of the models presented in Table 14. Thus, these results indicate the influence of professional development attendance (not the effect of assignment to Tx controlling for amount of professional development attendance, or vice versa).

Results for Research Question 3: Did principal characteristics, such as years of experience, gender, or area of certification, moderate the impact of LMSI professional development on principals' attitudes toward leading the implementation of NGSSS?

For research question three, when investigating years of experience as a moderator, the baseline model (Table 15, Model 1, Appendix D) is the final model from research question one – Stages 0 (Awareness), 3 (Management), 4 (Consequence), and 5 (Collaboration) regressed onto Tx, controlling for pretest CFSoCQ highest stage. Building on the baseline model, Model 2 includes total years of experience (years as principal plus years as teacher) as a covariate; finally, Model 3 tests the interaction between Tx and total years of experience. Results of the MLR analyses indicate there is not a statistically significant association between total years of experience and principals' posttest highest stage of concern. Additionally, the interaction of Tx and total years of experience was not statistically significant. Thus, I found no evidence that years of experience covaries with posttest stage of concern nor any evidence that it moderates the effect of Tx on predicting posttest stage of concern. The result was the same for the investigation of the relation between gender and principals' highest stage of concern, (Table 16, Appendix D) and the investigation of the relation between area of certification and principals' highest stage of concern (Table 17, Appendix D); none of the potential covariates or moderators investigated resulted in statistically significant estimates.

CHAPTER FIVE

DISCUSSION

The primary aim of this study was to test whether assignment to attend the LMSI professional development had an effect on elementary principals' self-reported attitudes toward leading implementation of the then-new content standards for the state: Florida's Next Generation Sunshine State Standards (NGSSS) in Mathematics and Science. A secondary aim of the study was to investigate the effect of actual participation, as measured by hours of professional development attendance. A tertiary aim of the study was to determine whether principal characteristics covaried with outcomes associated with the LMSI intervention and whether principal characteristics moderated the effect of the LMSI professional development intervention. Overall, principals' responses show that their concerns related to leading these change efforts were significantly impacted as a result of assignment to the professional development condition and related to hours of professional development attendance. Principals in this sample indicated at the outset of the study that their primary concerns around facilitating the uptake of the NGSSS centered on their perceived need for information about the NGSSS; these concerns included principals' expressed feelings of wanting more details about the content of the standards, information on any resources available to help with implementation, the primary aims of the new standards, as well as any available professional development opportunities. This baseline status suggests that principals entered the LMSI study with concerns that might be described as not only information-seeking, but also general in nature.

Assignment to professional development resulted in principals' self-reported concerns being nearly four times more likely to be centered on management of the implementation of the NGSSS as compared to principals in the comparison group. This suggests that assignment to professional development resulted in an increased likelihood of principals having concerns related to their ability to support their faculty as teachers work to adopt the NGSSS in their classroom practice. These management concerns are focused on planning, scheduling, and resource allocation related to implementation of NGSSS in their school sites. Assignment to professional development also resulted in principals' self-reported concerns being more than six times more likely to be centered on the consequences of the implementation of the NGSSS to

their faculty as compared to principals in the comparison group. These concerns about consequences are characterized by a focus on the impacts on teachers as they work to change their practice, and how principals' readiness to lead the implementation efforts might best meet the needs of their faculty and support the faculty's ability to adapt to consequences associated with changes in their practice. In this context, consequences to the faculty might include: relevance of the changes in the standards to teachers' work; how transitioning to the NGSSS may impact teachers' evaluations; and how principals might best help teachers perform well under these new conditions. Finally, assignment to professional development resulted in principals' self-reported concerns being nearly nine times more likely to be centered on collaboration with others around implementation of the NGSSS than principals in the comparison group. Concerns related to collaboration – as measured by the CFSoCQ – indicate a desire on the part of the principal for opportunities to work with other administrators as they lead implementation efforts in their schools, share what they have learned about the NGSSS with other administrators, and learn from other administrators about how best to lead these change efforts.

Taken together, the results from research question one suggest that assignment to the professional development condition operated in the way the logic model posited, with principals assigned to professional development reporting a significant change in their initial status of a primary focus on needing more information about the basic aims, requirements, and structure of the NGSSS to concerns related to management, consequences, and collaboration around the NGSSS. Given that the professional development was designed to improve: (a) mathematics and science content knowledge; (b) knowledge of the mathematics and science NGSSS and how these differ from prior standards; (c) improved understanding of the level of instruction called for by the NGSSS; and (d) strategies for supporting changes in teachers' practice, we would expect to see principals less concerned about basic knowledge related to the mathematics and science NGSSS as a result of the professional development opportunity. The increased likelihood of a focus on management, consequence, or collaboration concerns indicates that principals assigned to the professional development condition transitioned to concerns around how they might best support teachers, help teachers mitigate the stressors associated with transitioning to the NGSSS, and work with other administrators through this transition process.

Based on the findings for research question one, we might expect to see principals assigned to the intervention condition achieve greater success with facilitating the

implementation of the NGSSS in their schools. A few of the specific questions related to the three stages where principals assigned to professional development were more likely to report concerns at posttest include:

1. I am concerned about finding and allocating the time needed for implementing this innovation. (Management)
2. I would like to modify my mode of facilitation of the NGSSS based on the experiences of those directly involved in its use. (Consequence)
3. I would like to help others in facilitating the use of the NGSSS. (Collaboration)

Based on posttest results, principals in the professional development intervention are much more likely to be focused on the types of concerns outlined in the questions above; these findings indicate that the intervention was successful at provoking an interest in finding solutions to potential roadblocks and developing principals' will to lead their schools in implementing the NGSSS.

With regard to the influence of actual participation in the professional development on principals' attitudes toward leading the implementation of the NGSSS, results suggest that increased levels of attendance are positively related to changes in self-reported concerns about leading the transition and adoption of the NGSSS in their schools. Given that the LMSI professional development was designed to place a strong emphasis on a face-to-face delivery format, and project resource allocation was built around this priority, findings related to research question two are of particular interest. As previously noted, the knowledge base around professional development impacts for school principals is severely limited. At the time the LMSI study was being designed, the best evidence available on the importance of duration for professional development impacts came from studies of professional development for teachers; the teacher professional development literature pointed to an emphasis on increased duration of professional development training as being one of the key features of effective training. As such, the LMSI program was designed to allow for in-depth coverage of content, time for principals to engage in hands-on learning activities, and opportunities for principals to work collaboratively during training sessions. The logic model underpinning this program prioritized both face-to-face and between sessions learning occasions for principals spaced over one calendar year in an effort to provide sufficient duration for changes in principals' readiness to lead these implementation efforts in their school sites.

The increase in odds of reported concerns at posttest centered on either management, consequence, or collaboration mirror the results for research question one, but allow for an estimation of the practical importance of attendance and participation. That each hour of attendance/participation results in an increased likelihood of 2% for concerns about managing the implementation, 3% for concerns related to consequences of the implementation, and 4% for collaboration speaks directly to the importance of duration. In practical terms, these numbers mean that for each two-day face-to-face session averaging 18 hours, the increased odds of principals expressing concerns related to managing the implementation of the NGSSS was 36%, the increased odds of principals expressing concerns related to the consequences of implementation was 54%, and the increased odds of principals expressing concerns related to collaboration with other administrators as they work to lead implementation of the new standards was 72%. These results offer compelling evidence for the prioritization of duration when planning professional development training for elementary school principals.

None of the principal characteristics investigated in this study were found to covary with LMSI outcomes or relate to LMSI professional development impacts on principals' attitudes toward leading the implementation of NGSSS; it is important to note that this study was not designed a priori to test these relations. Within the sample, there was a range of years of experience, but both gender and areas of certification were somewhat limited in variability (85% female and 71% certified elementary educator). In the academic literature on educational leadership, there are many exploratory qualitative studies that support the notion of gender as an important factor related to successful leadership practice (Deem, 2003; Madden, Slavin, & Simmons, 1999) with little support from confirmatory studies (Northous, 2004). The findings from this study do not further the knowledge base around the importance of principal characteristics for professional development impacts.

Limitations

Given that (a) principals were randomly assigned to condition, (b) missing data satisfy conditions of being considered missing at random, and (c) the two groups were equivalent on the outcome of interest at baseline, this study provides an adequate test of the effects of assignment to attend LMSI PD on elementary principals' self-reported readiness to lead implementation of NGSSS in their schools. Principals were not randomly assigned to varying levels of participation (e.g., hours of attendance and between sessions activities), so the results of exploratory analyses

supporting increased levels of participation in LMSI professional development as important for principals' concerns related to implementation must be interpreted more cautiously.

Some limitations with the data merit comment. First, the use of multinomial logistic regression, while in line with the instrument developer's conceptualization of how the stages of concern should be operationalized, resulted in low cell counts for several combinations of covariates and the result for this study was multiple cases of underdispersion. Where larger-than-expected standard errors were found, coefficients were considered inadmissible. It is possible that a larger sample and/or more time points of data collection might ameliorate these problems. This limitation does not change the overall outcome – and in no way diminishes the trustworthiness of the results for the impact of treatment – but it does bear mention.

It is also important to distinguish between principals' self-reported readiness to lead implementation of the NGSSS and successful leadership of the transition to the new standards. The limitations of self-report questionnaires (Nisbett & Wilson, 1977) notwithstanding, there is evidence to support people's ability to accurately report on their attitudes and beliefs (Brown, 1999; Ericsson & Simon, 1980). Because the CFSoCQ is designed to capture principals' perceptions of their readiness to lead a change effort, this study does not allow for understanding how well principals actually facilitated the implementation of the NGSSS in their school sites and worked to meet policy expectations and intentions. Thus, given that the ultimate goal of the policy involves actual implementation, additional research incorporating direct measures of principals' leadership for leading adoption of new standards is warranted.

Next Steps

Important next steps for investigation of principals' attitudes toward readiness to lead implementation of new standards in their schools would include study of both elementary and secondary grades' principals, and samples with greater diversity in principal characteristics variables. It is also desirable to execute a study designed to allow for confirmatory analyses of the importance of dosage. As previously noted, studies incorporating direct, objective measures of principals' leadership for implementation of new standards are warranted.

Implications

Regarding the results of this study in the context of the LMSI logic model, it appears as though principals assigned to attend the LMSI professional development perceived themselves as more ready to lead the implementation of the NGSSS in their schools at posttest, as compared to

those principals in the comparison condition, based on the shifts in highest stage of concern demonstrated from pre- to posttest for both groups. Where principals felt more focused on the actual management of implantation of the new standards, consequences to faculty of this transition, and opportunities for collaboration, it is possible that moving beyond primary concerns related to information was a result of improved knowledge of the standards themselves, an increased understanding of the changes in instruction called for by the new standards, and a greater facility at supporting communities of instructional practice in their schools; these pre-post- group differences may also be a result of some combination of the aforementioned components of the LMSI logic model. The results of this study support the LMSI logic model further by indicating that principals see the implementation as a worthwhile activity, and something important for the faculty to focus on; this last finding is drawn from the lack of high endorsement of stage six (Refocusing) by principals assigned to the professional development condition at posttest.

Considering that the analytic sample in this study represents 31 of Florida's 67 districts, it includes a range of Florida's elementary principals, whereby findings may generalize to elementary principals throughout the state. Of the districts represented in this sample, nearly half are high-need districts, and there are urban, suburban, and rural districts retained in the analytic sample. In practical terms, results of this study offer compelling evidence for principal professional development programs as a means of impacting elementary grades principals' attitudes toward leadership for reform efforts. Findings from research question one show that assignment to professional development did improve principals' perceptions of their readiness to lead their schools in transitioning to the NGSSS. To the extent that principal attitude toward implementation is influential for actual implementation, investments in principal professional development are merited. Policymakers and district officials who seek to influence principals' will for policy adoption may consider structuring principal professional development to allow for sufficient duration of participation. In today's K-12 educational context, principal support for the transition to the CCSS is likely to be a top priority for policymakers and district leaders in those states making this transition.[3] The fact that this includes a majority of the United States' public education sector makes the results of this study particularly relevant in today's policy environment.

[3] In Florida The Florida Standards are adopted in plae of the Common Core State Standards.

APPENDIX A

LOGIC MODEL FOR LEADERSHIP FOR MATHEMATICS AND SCIENCE INSTRUCTION (LMSI) STUDY

Table 12. Logic Model for LMSI Study

CONTEXT	INPUTS	ACTIVITIES	OUTPUTS	OUTCOMES
State Board of Education replaces *SSS* with *NGSSS.* Statewide MSP (Florida PROMiSE) aims to prepare educators to make changes in instruction required to fulfill aims of mandated change in standards. Florida State University directs the principal training -- Leadership for Mathematics and Science Instruction (LMSI) project. LMSI PD designed to build will and capacity for implementation *NGSSS.* Principals invited to receive LMSI PD.	Elementary principals register to receive year-long LMSI PD. Expert facilitators to lead LMSI PD for principals. LMSI PD training materials for: • *NGSSS in Math and Science* • *Mathematics and Science content knowledge* • *Mathematics and Science instructional activities* • *Communities of Instructional Practice* Resources allocated for study of LMSI PD impacts. Receipt of LMSI PD is not contingent on participation in study.	4 face-to-face LMSI PD two-day sessions with lessons and activities on math and science depth of knowledge, classroom observations (videos), classroom observation protocol to guide standards based classroom observations, algebraic thinking, communities of instructional practice, lesson study Between session activities include having principals teach a model lesson in their schools, explore the standards database (e.g., scavenger hunt), reading journal articles and books related to improving instruction and observations.	Better understanding of the level of instruction called for by the *NGSSS*. Gain confidence in their classroom observation skills via the observation of videos. Gain content knowledge in mathematics and science. Gain understanding of *NGSSS* and instructional changes designed to support implementation. Facilitate Communities of Instructional Practice that prioritize focus on instructional changes related to *NGSSS*. Design strategies to support changes in teacher practice.	Principals' self-report readiness to lead implementation via: • Improved understanding of the *NGSSS*, and how these differ from *SSS*. • Support implementation of *NGSSS* as an important goal for their faculty. • Improved confidence in their ability to meet the demands of leading this change initiative.

Note. SSS = Sunshine State Standards. NGSSS = Next Generation Sunshine State Standards. MSP = Math & Science Partnership. PROMiSE = Partnership to Rejuvenate & Optimize Mathematics and Science Education. LMSI = Leadership for Mathematics and Science Instruction. PD = Professional Development.

APPENDIX B

PARTICIPANT FLOWCHART FOR LEADERSHIP FOR MATHEMATICS AND SCIENCE INSTRUCTION (LMSI) STUDY

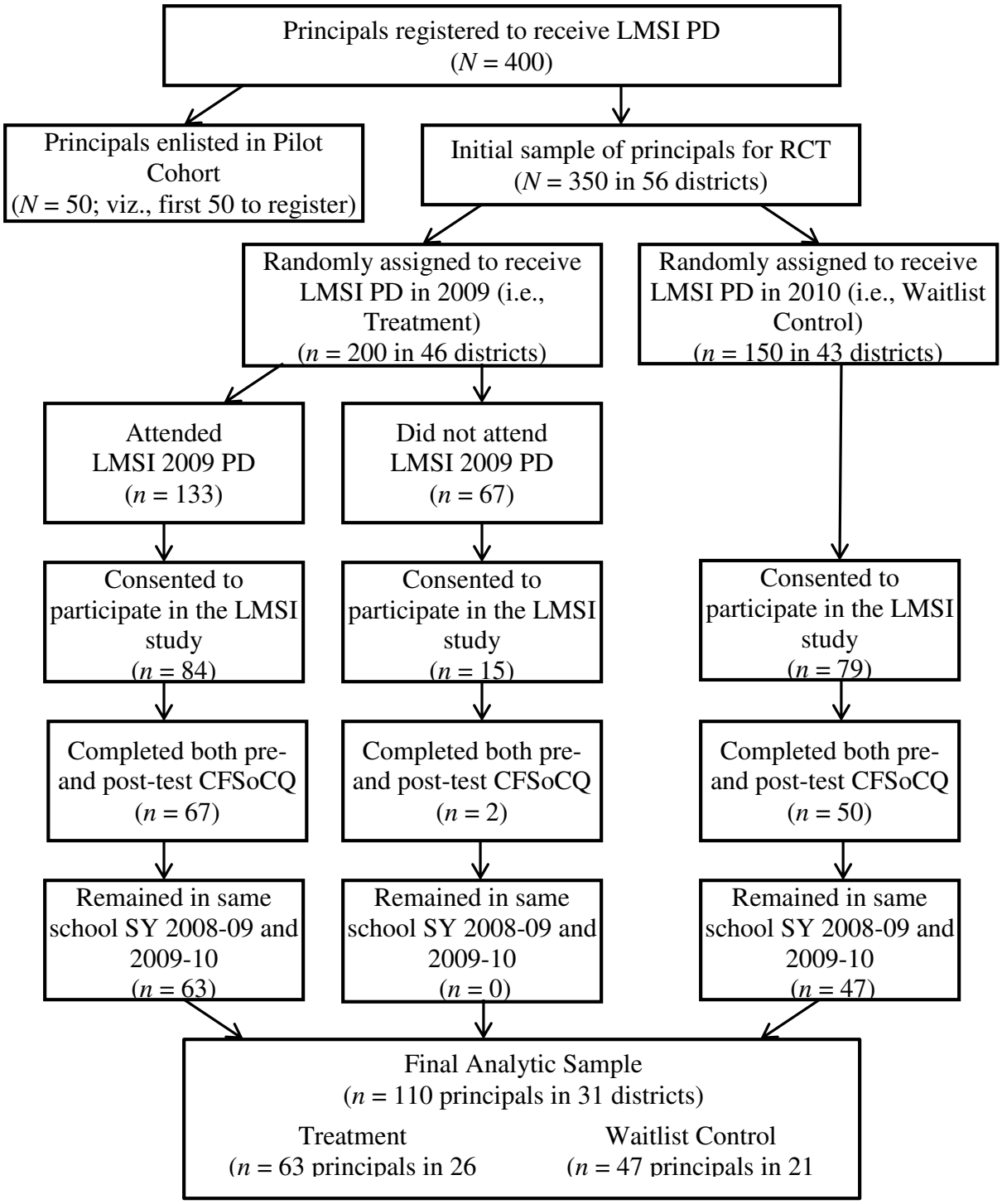

Figure 1. Participant Flowchart. Illustrating the reduction of sample size from the initial sample of registered principals to the final analytic sample, based on the sequential filtering by whether the principal consented to participate in the study, completed both pre-and post-measures, and remained in the same school during SY 2008-09 and 2009-10. LMSI = Leadership for Mathematics and Science Instruction. PD = Professional Development. RCT = Randomized Controlled Trial. CFSoCQ = Change Facilitator Stage of Concern Questionnaire. SY = School Year.

APPENDIX C

STAGES OF CONCERN QUESTIONNAIRE PRE- AND POSTTEST HIGHEST STAGES

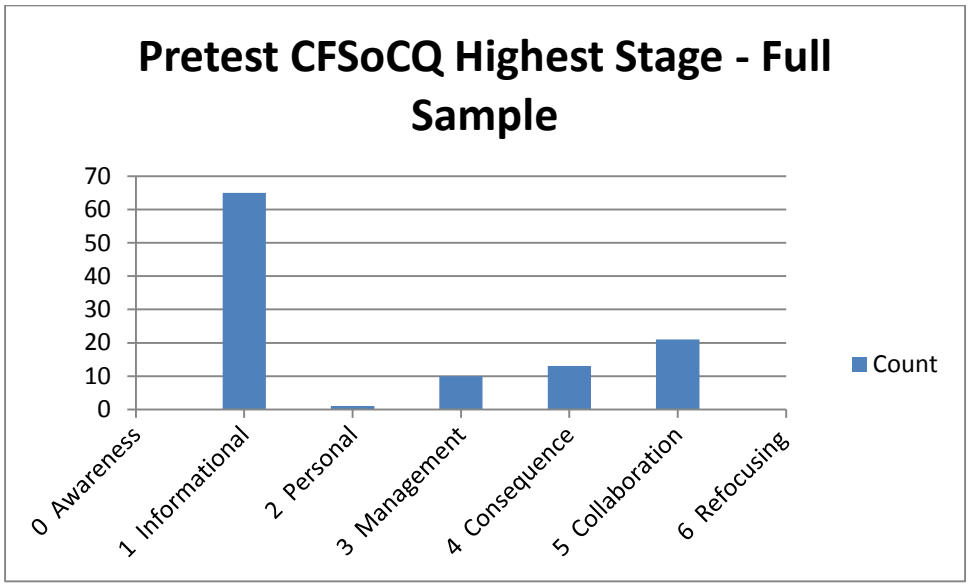

Figure 2. Pretest CFSoCQ Highest Stage - Full Sample

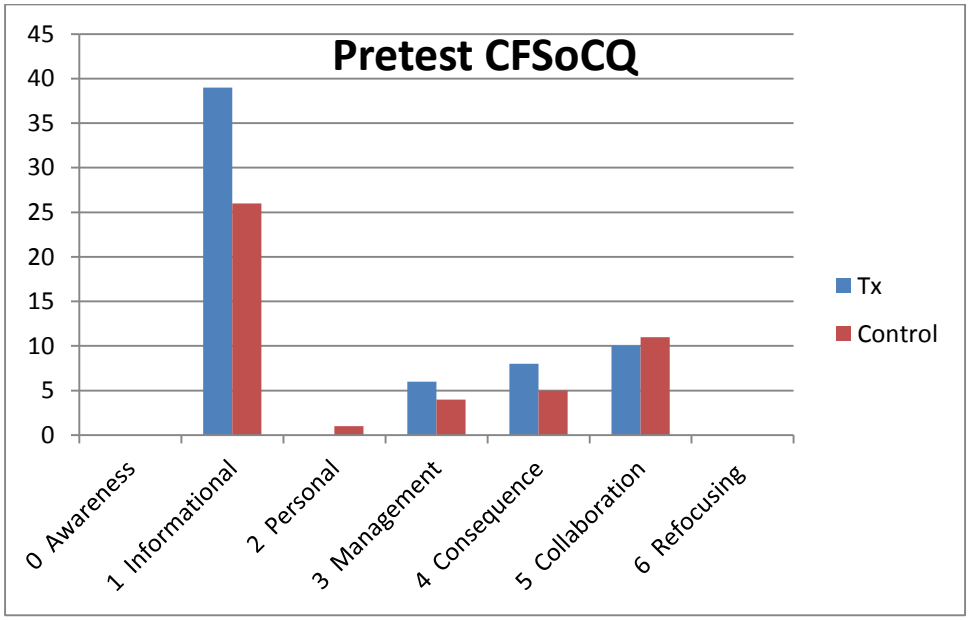

Figure 3. Pretest CFSoCQ Disaggregated by Group.

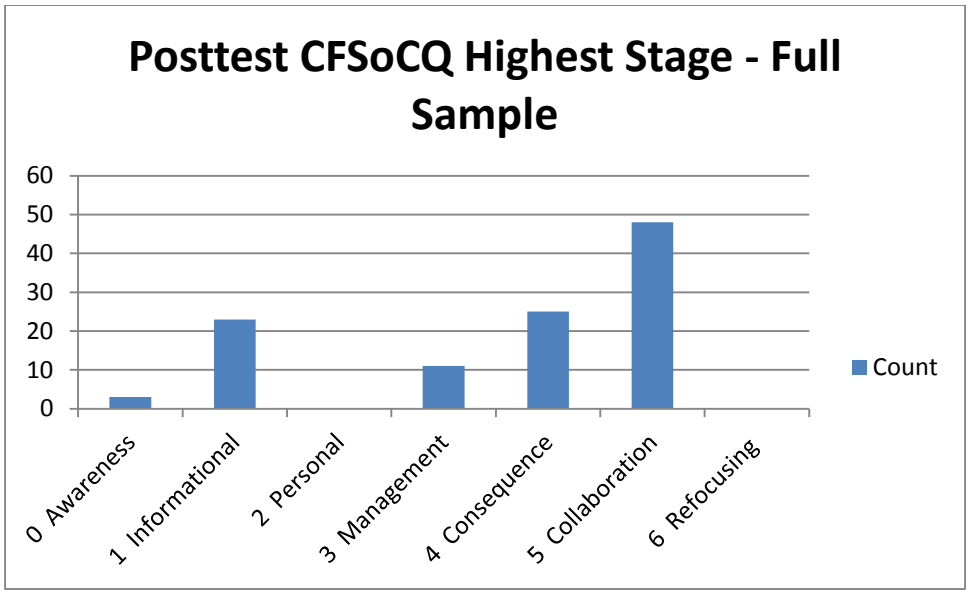

Figure 4. Posttest CFSoCQ Highest Stage - Full Sample.

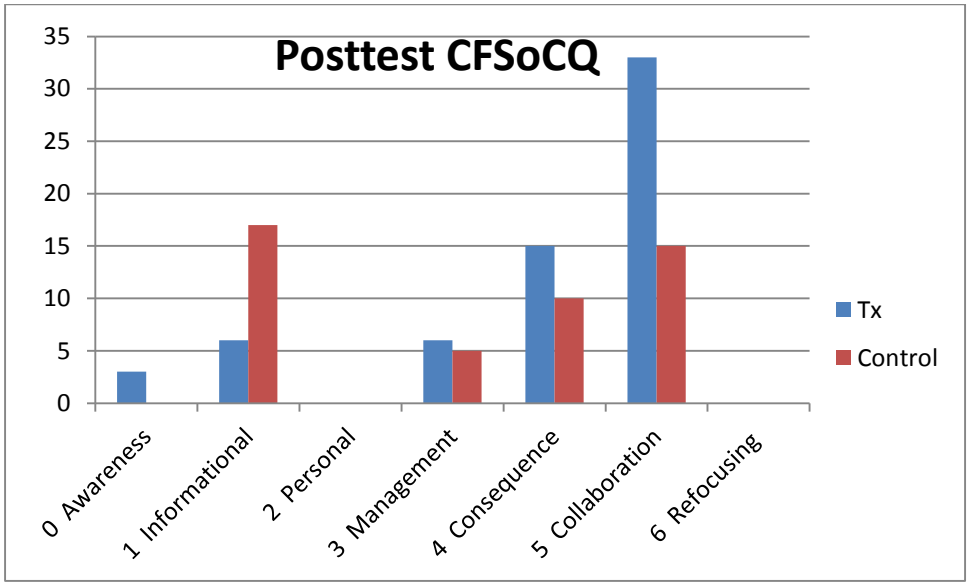

Figure 5. Posttest CFSoCQ Disaggregated by Group.

APPENDIX D

MUTINOMIAL LOGISTIC REGRESSION RESULTS

Table 13
Confirmatory Analyses Treating CFSoCQ as Nominal

Posttest highest stage		Model 1 Log odds	*SE*	*p*	Model 2 Log odds	*SE*	*p*	OR
0 Awareness	Intercept	-20.69	.71	.00	-27.80	830.43	.97	
	Treatment	19.99	.00	—	15.32	454.39	.97	>999.0[a]
	Pre Stage 2				11.45	696.61	.99	>999.0[b]
	Pre Stage 3				25.76	0.00	—	>999.0[c]
	Pre Stage 4				12.10	3249.82	.98	>999.0[d]
	Pre Stage 5				14.13	696.62	.98	>999.0[e]
3 Management	Intercept	-1.22	.51	.02	-13.92	423.77	.94	
	Treatment	1.22	.77	.11	1.36	0.56	.02	3.90
	Pre Stage 2				11.94	423.77	.98	>999.0[f]
	Pre Stage 3				13.18	5712.23	.99	>999.0[g]
	Pre Stage 4				29.93	1193.12	.98	>999.0[h]
	Pre Stage 5				13.48	423.77	.98	>999.0[i]
4 Consequence	Intercept	-.53	.40	.18	0.45	0.57	.43	
	Treatment	1.45	.63	.02	1.81	0.44	.00	6.10
	Pre Stage 2				-1.69	0.62	.00	0.18
	Pre Stage 3				16.59	3107.05	—	>999.0[j]
	Pre Stage 4				-1.31	1637.71	.99	0.27
	Pre Stage 5				0.48	0.92	.61	1.62
5 Collaboration	Intercept	-.13	.35	.72	1.30	0.52	.01	
	Treatment	1.83	.57	.00	2.18	0.41	.00	8.9
	Pre Stage 2				-2.28	0.57	.00	0.10
	Pre Stage 3				-0.56	3857.20	—	0.57
	Pre Stage 4				14.22	1115.33	—	>999.0[k]
	Pre Stage 5				-0.60	0.91	.51	0.55

Note. Reference category is Stage 1 Informational. OR = Odds Ratio. Values for Odds Ratios >999.0 are considered inadmissible.
[a]4507146.72; [b]94062.34; [c]0000000000001.542; [d]179464.95; [e]1375567.23; [f]153516.83; [g]531320.46; [h]00000000000001001; [i]715211.70; [j]16059269.27; [k]16059269.27.

Table 14
Multinomial Logistic Regression Analyses of CFSoCQ Posttest Highest Stage From Hours of Professional Development Attended

		Model 1			Model 2			
Posttest highest stage		Log odds	*SE*	*p*	Log odds	*SE*	*p*	OR
0 Awareness	Intercept	-293.64	0.74	.00	-171.15	1063.74	.87	
	PD Hours	3.86	0.00	—	2.11	12.28	.86	8.27
	Pre Stage 2				10.10	510.32	.98	>9999.0[a]
	Pre Stage 3				169.12	7617.77	.98	>9999.0[b]
	Pre Stage 4				10.84	0.00	—	>9999.0[c]
	Pre Stage 5				12.53	510.32	.98	>9999.0[d]
3 Management	Intercept	-1.28	0.50	.01	-12.95	330.53	.97	
	PD Hours	0.02	0.01	.06	0.02	0.01	.03	1.02
	Pre Stage 2				10.88	330.53	.97	>9999.0[e]
	Pre Stage 3				12.21	4516.84	.99	>9999.0[f]
	Pre Stage 4				31.13	3992.73	.98	>9999.0[g]
	Pre Stage 5				12.44	330.53	.98	>9999.0[h]
4 Consequence	Intercept	-0.53	0.39	.17	0.51	0.73	.49	
	PD Hours	0.02	0.01	.01	0.03	0.01	.00	1.03
	Pre Stage 2				-1.74	0.79	.03	0.18
	Pre Stage 3				15.54	2562.28	.99	>9999.0[i]
	Pre Stage 4				-1.33	6107.62	1.0	0.27
	Pre Stage 5				0.43	1.18	.72	1.54
5 Collaboration	Intercept	-0.24	0.35	.50	1.25	0.66	.06	
	PD Hours	0.03	0.01	.00	0.04	0.01	.00	1.04

Table 14 - continued

Posttest highest stage		Model 1			Model 2			
		Log odds	*SE*	*p*	Log odds	*SE*	*p*	OR
	Pre Stage 2				-2.41	0.74	.00	.09
	Pre Stage 3				-.52	3116.26	1.0	.60
	Pre Stage 4				16.36	3979.02	.99	>9999.0[j]
	Pre Stage 5				-.73	1.17	.53	.48

Note. Reference category is Stage 1 Informational. OR = Odds Ratio. Values for Odds Ratios >999.0 are considered inadmissible.
[a]24217.19; [b]2.793E+73; [c]50953.22; [d]75967.42; [e]53188.67; [f]201249.44 ; [g].00000000000003296; [h]253667.45; [i]5617889.11; [j]12784547.72.

Table 15
Multinomial Logistic Regression Analyses Exploring Years of Experience (as Principal and Teacher Combined) as Predictive

Posttest highest stage[a]		Model 1[b]			Model 2[c]			Model 3[d]		
		Log odds	*SE*	*p*	Log odds	*SE*	*p*	Log odds	*SE*	*p*
0 Awareness	Intercept	-27.80	830.43	.97	-27.09	921.02	.98	-26.85	1996.27	.99
	Tx	15.32	454.39	.97	14.69	398.13	.97	14.42	1804.71	.99
	Yrs_Exp				-0.02	0.10	.80	0.00	109.71	1.00
	Yrs_Exp*Tx							0.02	109.72	1.00
	Pre Stage 2	11.45	696.61	.99	10.80	831.70	.99	10.86	841.99	.99
	Pre Stage 3	25.76	0.00	—	24.20	0.00	—	24.78	0.00	—
	Pre Stage 4	12.10	3249.82	.98	11.50	3958.32	.99	11.69	3877.52	.99
	Pre Stage 5	14.13	696.62	.98	14.14	831.70	.99	14.23	841.99	.99
3 Management	Intercept	-13.92	423.77	.94	-14.44	443.35	.97	-16.70	417.40	.97
	Tx	1.36	0.56	.02	-13.67	597.40	.98	5.62	2.44	.02
	Yrs_Exp				0.03	0.09	.75	0.18	0.08	.17
	Yrs_Exp*Tx							-0.23	.12	.06
	Pre Stage 2	11.94	423.77	.98	11.53	443.34	.98	11.28	417.39	.98
	Pre Stage 3	13.18	5712.23	.99	12.40	5468.89	.99	11.61	5548.51	.99
	Pre Stage 4	29.93	1193.12	.98	28.62	1211.10	.98	28.84	1199.29	.98

Table 15 - continued

Posttest highest stage[a]		Model 1[b]			Model 2[c]			Model 3[d]		
		Log odds	*SE*	*p*	Log odds	*SE*	*p*	Log odds	*SE*	*p*
		Log odds	*SE*	*p*	Log odds	*SE*	*p*	Log odds	*SE*	*p*
	Pre Stage 5	13.48	423.77	.98	12.99	443.35	.98	13.17	417.39	.98
4 Consequence	Intercept	0.45	0.57	.43	-.26	443.34	.98	-0.52	1.40	.71
	Tx	1.81	0.44	.00	-13.53	597.40	.98	2.46	1.74	.16
	Yrs_Exp				0.02	0.09	.82	0.06	0.07	.43
	Yrs_Exp*Tx							-0.04	.08	.65
	Pre Stage 2	-1.69	0.62	.00	-1.71	0.84	.98	-1.67	0.85	.05
	Pre Stage 3	16.59	3107.05	—	15.59	3047.93	.99	15.54	3094.60	.99
	Pre Stage 4	-1.31	1637.71	.99	-1.43	1684.43	.99	-1.295	1666.52	.99
	Pre Stage 5	0.48	0.92	.61	0.51	1.23	.68	0.58	1.25	.64
5 Collaboration	Intercept	1.30	0.52	.01	0.59	0.98	.55	1.67	1.34	
	Tx	2.18	0.41	.00	2.62	0.64	.00	1.28	1.66	.44
	Yrs_Exp				0.01	0.09	.90	-0.04	0.08	.63
	Yrs_Exp*Tx							0.06	0.00	.99
	Pre Stage 2	-2.28	0.57	.00	-2.23	0.78	.78	-2.17	0.79	.99
	Pre Stage 3	-0.56	3857.20	—	-0.73	3761.96	.99	-0.03	3819.02	1.00
	Pre Stage 4	14.22	1115.33	—	13.72	1127.03	.99	13.75	1124.31	.99

Table 15 - continued

Posttest highest stage[a]		Model 1[b]			Model 2[c]			Model 3[d]		
		Log odds	*SE*	*p*	Log odds	*SE*	*p*	Log odds	*SE*	*p*
	Pre Stage 5	-0.60	0.91	.51	-0.69	1.23	.58	-0.653	1.24	.60

Note. Tx = effect of treatment (dummy coded 0 and Control dummy coded 1). Yrs_Exp = total years of experience as principal plus total years experience as teacher. Yrs_Exp*Tx = interaction of years of experience and treatment.
[a]Reference category is Stage 1 (Informational). [b]Model 1 estimates impact of Tx on likelihood of posttest highest CFSoCQ controlling for pretest. [c]Model 2 adds Yrs_Exp as a predictor variable. [d]Model 3 adds the interaction of Yrs_Exp*Tx.

Table 16
Multinomial Logistic Regression Analyses Exploring Gender as Predictive

Posttest highest stage[a]		Model 1[b]			Model 2[c]			Model 3[d]		
		Log odds	*SE*	*p*	Log odds	*SE*	*p*	Log odds	*SE*	*p*
0 Awareness	Intercept	-27.80	830.43	.97	-36.6	279.68	.90	-38.93	470.87	.93
	Tx	15.32	454.39	.97	13.68	131.64	.92	13.85	256.26	.96
	Male				14.40	164.58	.93	12.23	697.32	.99
	Male*Tx							1.97	664.63	.99
	Pre Stage 2	11.45	696.61	.99	10.15	183.87	.96	11.72	334.77	.97
	Pre Stage 3	25.76	0.00	—	34.56	5690.78	.96	36.89	0.00	—
	Pre Stage 4	12.10	3249.82	.98	11.04	4677.35	.99	15.45	2882.46	.99
	Pre Stage 5	14.13	696.62	.98	24.54	246.77	.92	26.90	395.60	.95
3 Management	Intercept	-13.92	423.77	.94	-12.77	251.29	.96	-13.20	285.63	.96
	Tx	1.36	0.56	.02	1.26	0.55	.02	1.25	.54	.02
	Male				-0.91	0.84	.23	-1.27	1.00	.21

Table 16 continued

Posttest highest stage[a]		Model 1[b]			Model 2[c]			Model 3[d]		
		Log odds	*SE*	*p*	Log odds	*SE*	*p*	Log odds	*SE*	*p*
	Male*Tx							-0.01	1.42	.96
	Pre Stage 2	11.94	423.77	.98	10.95	251.23	.97	11.42	285.63	.97
	Pre Stage 3	13.18	5712.23	.99	12.04	3403.69	.99	12.46	4008.47	.99
	Pre Stage 4	29.93	1193.12	.98	32.33	251.23	.96	31.95	2784.97	.99
	Pre Stage 5	13.48	423.77	.98	12.38	251.23	.96	12.86	285.63	.96
4 Consequence	Intercept	0.45	0.57	.43	0.53	0.57	.35	0.44	0.52	.39
	Tx	1.81	0.44	.00	1.77	0.43	.00	2.14	0.42	.00
	Male				-0.39	0.64	.55	0.60	0.62	.34
	Male*Tx							-19.15	3138.69	.96
	Pre Stage 2	-1.69	0.62	.00	-1.71	0.59	.00	-1.84	0.55	.00
	Pre Stage 3	16.59	3107.05	—	15.51	1930.73	.99	16.17	2180.54	.99

Table 16 continued

Posttest highest stage[a]		Model 1[b]			Model 2[c]			Model 3[d]		
		Log odds	*SE*	*p*	Log odds	*SE*	*p*	Log odds	*SE*	*p*
	Pre Stage 4	-1.31	1637.71	.99	-1.15	5277.71	1.0	-1.58	4474.50	1.00
	Pre Stage 5	.48	0.92	.61	0.41	0.90	.65	0.37	0.82	.65
5 Collaboration	Intercept	1.30	0.52	.01	1.35	0.52	.01	1.33	0.47	.004
	Tx	2.18	0.41	.00	2.16	0.40	.00	2.32	0.39	.00
	Male				-0.25	0.55	.65	-0.10	0.62	.88
	Male*Tx							-1.06	1.00	.29
	Pre Stage 2	-2.28	0.57		-2.28	0.55	.00	-2.32	0.50	.00
	Pre Stage 3	-.56	3857.20	.99	-0.61	2348.17	1.0	-0.59	2707.15	1.0
	Pre Stage 4	14.22	1115.33	.97	17.39	0.00		16.51	2770.28	.99
	Pre Stage 5	-.60	0.91	.51	-0.66	0.88	.46	-0.63	0.79	.43

Note. Tx = effect of treatment (dummy coded 0 and Control dummy coded 1). Male*Tx = interaction of male and treatment.
[a]Reference category is Stage 1 (Informational). [b]Model 1 estimates impact of Tx on likelihood of posttest highest CFSoCQ controlling for pretest. [c]Model 2 adds Male as a predictor variable. [d]Model 3 adds the interaction of Male*Tx.

Table 17
Multinomial Logistic Regression Analyses Exploring Elementary Educator Certification as Predictive

		Model 1[b]			Model 2[c]			Model 3[d]		
Posttest highest stage[a]		Log odds	*SE*	*p*	Log odds	*SE*	*p*	Log odds	*SE*	*p*
0 Awareness	Intercept	-27.80	830.43	.97	-18.99	58.34	.75	-25.10	250.15	.92
	Tx	15.32	454.39	.97	25.30	29.85	.40	26.14	136.26	.85
	Not_Elem				-24.93	40.48	.54	-14.83	636.16	.98
	Not _Elem*Tx							-11.10	667.59	.98
	Pre Stage 2	11.45	696.61	.99	6.50	52.21	.90	9.44	217.39	.97
	Pre Stage 3	25.76	0.00	.98	16.85	650.91	.98	22.96	2827.24	.99
	Pre Stage 4	12.10	3249.82	.98	20.88	0.00	.98	19.35	0.00	.97
	Pre Stage 5	14.13	696.62	.98	17.07	53.18	.75	24.71	239.60	.92
3 Management	Intercept	-13.92	423.77	.94	-9.16	28.50	.75	-12.23	126.43	.92
	Tx	1.36	0.56	.02	14.82	14.60	.31	12.67	57.02	.82
	Not _Elem				-15.46	14.60	.29	-12.64	196.62	.95

Table 17 continued

		Model 1[b]			Model 2[c]			Model 3[d]		
Posttest highest stage[a]		Log odds	*SE*	*p*	Log odds	*SE*	*p*	Log odds	*SE*	*p*
	Not _Elem*Tx							-.81	204.73	.99
	Pre Stage 2	11.94	423.77	.98	7.56	28.50	.79	10.58	126.43	.93
	Pre Stage 3	13.18	5712.23	.99	8.52	358.63	.98	11.59	1558.10	.99
	Pre Stage 4	29.93	1193.12	.98	40.92	1187.49	.97	38.97	421.88	.93
	Pre Stage 5	13.48	423.77	.98	6.10	54.02	.91	10.69	246.30	.97
4 Consequence	Intercept	0.45	0.57	.43	1.21	0.35	.00	1.20	0.34	.00
	Tx	1.81	0.44	.00	15.79	14.59	.28	13.46	57.02	.94
	Not _Elem				-15.51	14.59	.29	-26.87	361.81	.94
	Not _Elem*Tx							13.69	366.28	.97
	Pre Stage 2	-1.69	0.62	.99	-2.28	0.38	.97	-2.27	0.37	.97
	Pre Stage 3	16.59	3107.05	.98	11.80	210.34	.96	14.81	913.68	.99
	Pre Stage 4	-1.31	1637.71	.99	11.09	2202.74	.99	6.59	1586.96	.99

Table 17 continued

		Model 1[b]			Model 2[c]			Model 3[d]		
Posttest highest stage[a]		Log odds	*SE*	*p*	Log odds	*SE*	*p*	Log odds	*SE*	*p*
	Pre Stage 5	0.48	0.92	.61	6.88	10.13	.49	11.59	101.02	.91
5 Collaboration	Intercept	1.30	0.52	.01	1.83	0.34	.00	1.83	0.33	.00
	Tx	2.18	0.41	.00	16.56	14.59	.26	-24.67	159.82	.88
	Not _Elem				-15.82	14.60	.28	-24.67	159.82	.88
	Not _Elem*Tx							11.21	169.69	.95
	Pre Stage 2	-2.28	0.57	.00	-2.90	0.37	.00	-2.88	0.36	.00
	Pre Stage 3	-0.56	3857.20	.99	-.88	247.66	.99	-.88	1075.80	.99
	Pre Stage 4	14.22	1115.33	.97	28.98	1187.14	.98	-24.13	402.48	.95
	Pre Stage 5	-0.60	0.91	.51	5.86	10.13	.56	10.57	101.02	.92

Note. Tx = effect of treatment (dummy coded 0 and Control dummy coded 1). Not_Elem = not certified elementary education. Not_Elem*Tx = interaction of not certified elementary teacher and treatment.

[a]Reference category is Stage 1 (Informational). [b]Model 1 estimates impact of Tx on odds of posttest highest CFSoCQ controlling for pretest. [c]Model 2 adds elementary educator certification as a predictor variable. [d]Model 3 adds the interaction of Not_Elem*Tx.

APPENDIX E

HUMAN SUBJECTS PERMISSIONS

The Florida State University
Office of the Vice President For Research
Human Subjects Committee
Tallahassee, Florida 32306-2742
(850) 644-8673, FAX (850) 644-4392

RE-APPROVAL MEMORANDUM

Date: 3/5/2015

To: Laura Lang [llang@fsu.edu]

Address: 2540
Dept.: LEARNING SYSTEMS INSTITUTE

From: Thomas L. Jacobson, Chair

Re: Re-approval of Use of Human subjects in Research
Principal PROMiSE Research Project

Your request to continue the research project listed above involving human subjects has been approved by the Human Subjects Committee. If your project has not been completed by 3/2/2016, you must request renewed approval by the Committee.

If you submitted a proposed consent form with your renewal request, the approved stamped consent form is attached to this re-approval notice. Only the stamped version of the consent form may be used in recruiting of research subjects. You are reminded that any change in protocol for this project must be reviewed and approved by the Committee prior to implementation of the proposed change in the protocol. A protocol change/amendment form is required to be submitted for approval by the Committee. In addition, federal regulations require that the Principal Investigator promptly report in writing, any unanticipated problems or adverse events involving risks to research subjects or others.

By copy of this memorandum, the Chair of your department and/or your major professor are reminded of their responsibility for being informed concerning research projects involving human subjects in their department. They are advised to review the protocols as often as necessary to insure that the project is being conducted in compliance with our institution and with DHHS regulations.

Cc: []
HSC No. 2015.14803

The Florida State University
Office of the Vice President For Research
Human Subjects Committee
Tallahassee, Florida 32306-2742
(850) 644-8673, FAX (850) 644-4392

RE-APPROVAL MEMORANDUM

Date: 4/11/2014

To: Laura Lang [llang@fsu.edu]

Address: 2540
Dept.: LEARNING SYSTEMS INSTITUTE

From: Thomas L. Jacobson, Chair

Re: Re-approval of Use of Human subjects in Research
Principal PROMiSE Research Project

Your request to continue the research project listed above involving human subjects has been approved by the Human Subjects Committee. If your project has not been completed by 4/8/2015, you must request renewed approval by the Committee.

If you submitted a proposed consent form with your renewal request, the approved stamped consent form is attached to this re-approval notice. Only the stamped version of the consent form may be used in recruiting of research subjects. You are reminded that any change in protocol for this project must be reviewed and approved by the Committee prior to implementation of the proposed change in the protocol. A protocol change/amendment form is required to be submitted for approval by the Committee. In addition, federal regulations require that the Principal Investigator promptly report in writing, any unanticipated problems or adverse events involving risks to research subjects or others.

By copy of this memorandum, the Chair of your department and/or your major professor are reminded of their responsibility for being informed concerning research projects involving human subjects in their department. They are advised to review the protocols as often as necessary to insure that the project is being conducted in compliance with our institution and with DHHS regulations.

Cc: []
HSC No. 2014.12479

The Florida State University
Office of the Vice President For Research
Human Subjects Committee
Tallahassee, Florida 32306-2742
(850) 644-8673, FAX (850) 644-4392

RE-APPROVAL MEMORANDUM

Date: 4/18/2013

To: Laura Lang [llang@fsu.edu]

Address: 2540
Dept.: LEARNING SYSTEMS INSTITUTE

From: Thomas L. Jacobson, Chair

Re: Re-approval of Use of Human subjects in Research
Principal PROMiSE Research Project

Your request to continue the research project listed above involving human subjects has been approved by the Human Subjects Committee. If your project has not been completed by 4/9/2014, you are must request renewed approval by the Committee.

If you submitted a proposed consent form with your renewal request, the approved stamped consent form is attached to this re-approval notice. Only the stamped version of the consent form may be used in recruiting of research subjects. You are reminded that any change in protocol for this project must be reviewed and approved by the Committee prior to implementation of the proposed change in the protocol. A protocol change/amendment form is required to be submitted for approval by the Committee. In addition, federal regulations require that the Principal Investigator promptly report in writing, any unanticipated problems or adverse events involving risks to research subjects or others.

By copy of this memorandum, the Chair of your department and/or your major professor are reminded of their responsibility for being informed concerning research projects involving human subjects in their department. They are advised to review the protocols as often as necessary to insure that the project is being conducted in compliance with our institution and with DHHS regulations.

Cc: []
HSC No. 2013.10235

Office of the Vice President For Research
Human Subjects Committee
Tallahassee, Florida 32306-2742
(850) 644-8673, FAX (850) 644-4392

RE-APPROVAL MEMORANDUM

Date: 4/13/2012

To: Laura Lang [llang@fsu.edu]

Address: 2540
Dept.: LEARNING SYSTEMS INSTITUTE

From: Thomas L. Jacobson, Chair

Re: Re-approval of Use of Human subjects in Research
Principal PROMiSE Research Project

Your request to continue the research project listed above involving human subjects has been approved by the Human Subjects Committee. If your project has not been completed by 4/10/2013, you are must request renewed approval by the Committee.

If you submitted a proposed consent form with your renewal request, the approved stamped consent form is attached to this re-approval notice. Only the stamped version of the consent form may be used in recruiting of research subjects. You are reminded that any change in protocol for this project must be reviewed and approved by the Committee prior to implementation of the proposed change in the protocol. A protocol change/amendment form is required to be submitted for approval by the Committee. In addition, federal regulations require that the Principal Investigator promptly report in writing, any unanticipated problems or adverse events involving risks to research subjects or others.

By copy of this memorandum, the Chair of your department and/or your major professor are reminded of their responsibility for being informed concerning research projects involving human subjects in their department. They are advised to review the protocols as often as necessary to insure that the project is being conducted in compliance with our institution and with DHHS regulations.

Cc: []
HSC No. 2012.7934

Office of the Vice President For Research
Human Subjects Committee
Tallahassee, Florida 32306-2742
(850) 644-8673, FAX (850) 644-4392

RE-APPROVAL MEMORANDUM

Date: 4/14/2011

To: Laura Lang [llang@fsu.edu]

Address: 2540
Dept.: LEARNING SYSTEMS INSTITUTE

From: Thomas L. Jacobson, Chair

Re: Re-approval of Use of Human subjects in Research
Principal PROMiSE Research Project

Your request to continue the research project listed above involving human subjects has been approved by the Human Subjects Committee. If your project has not been completed by 4/11/2012, you are must request renewed approval by the Committee.

If you submitted a proposed consent form with your renewal request, the approved stamped consent form is attached to this re-approval notice. Only the stamped version of the consent form may be used in recruiting of research subjects. You are reminded that any change in protocol for this project must be reviewed and approved by the Committee prior to implementation of the proposed change in the protocol. A protocol change/amendment form is required to be submitted for approval by the Committee. In addition, federal regulations require that the Principal Investigator promptly report in writing, any unanticipated problems or adverse events involving risks to research subjects or others.

By copy of this memorandum, the Chair of your department and/or your major professor are reminded of their responsibility for being informed concerning research projects involving human subjects in their department. They are advised to review the protocols as often as necessary to insure that the project is being conducted in compliance with our institution and with DHHS regulations.

Cc: []
HSC No. 2011.5922

Office of the Vice President For Research
Human Subjects Committee
Tallahassee, Florida 32306-2742
(850) 644-8673, FAX (850) 644-4392

RE-APPROVAL MEMORANDUM

Date: 5/14/2010

To: Laura Lang [llang@fsu.edu]

Address: 2540
Dept.: LEARNING SYSTEMS INSTITUTE

From: Thomas L. Jacobson, Chair

Re: Re-approval of Use of Human subjects in Research
Principal PROMiSE Research Project

Your request to continue the research project listed above involving human subjects has been approved by the Human Subjects Committee. If your project has not been completed by 5/11/2011, you are must request renewed approval by the Committee.

If you submitted a proposed consent form with your renewal request, the approved stamped consent form is attached to this re-approval notice. Only the stamped version of the consent form may be used in recruiting of research subjects. You are reminded that any change in protocol for this project must be reviewed and approved by the Committee prior to implementation of the proposed change in the protocol. A protocol change/amendment form is required to be submitted for approval by the Committee. In addition, federal regulations require that the Principal Investigator promptly report in writing, any unanticipated problems or adverse events involving risks to research subjects or others.

By copy of this memorandum, the Chair of your department and/or your major professor are reminded of their responsibility for being informed concerning research projects involving human subjects in their department. They are advised to review the protocols as often as necessary to insure that the project is being conducted in compliance with our institution and with DHHS regulations.

Cc: []
HSC No. 2010.4188

Request for Renewal Form

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Original Application Information View application

Project Title	Principal PROMiSE Research Project
Protocol Number	2009.2774
Review Type	Full Committee
Principal Investigator	Laura Lang
Approval Date	06/10/2009
Expiration Date	06/09/2010

Renewal Status

Note: The following questions pertain to the last approval period of the research project.

1. Was the study active in the last approval period?

Yes

2. ☐ No human subject research activities have occurred to date. For example: the research project has been placed on hold, no research activities have begun.
3. ☑ Subject recruitment and/or interventions occurred in the last approved period.
4. ☐ Following subjects. Enrollment was closed to new subjects in last approval period.
5. ☐ Data analysis of existing data and was approved as a existing data study. i.e. no subject involvement.
6. ☐ Open for data analysis only. No interaction with subject took place in the last approval period.
7. ☐ Completed (including all data analysis). Please upload copies of any pertinent publications that resulted.

Personnel Information

Have there been any changes in personnel (i.e. Principal Investigator, Co-Investigator and/or Research Staff)?

Yes

If yes, list role on project Name, Department, and Email Address

Kristina LaVenia, Co-PI, Educational Leadership and Policy Studies and PIRT Fellow at the Florida Center for Reading Research, kpineau@fsu.edu

Meghan Hauptli, Co-PI, Educational Leadership and Policy Studies and PIRT Fellow at the Florida Center for Reading Research, meghanhauptli@hotmail.com

Mark LaVenia, Co-PI, Educational Leadership and Policy Studies and PIRT Fellow at the Florida Center for Reading Research, ml06e@fsu.edu

Subject/Participant Information

Total sample size that was approved in the original application: 700

Total number of subjects since inception:	410
Total number of evaluable participants consented and enrolled in this research protocol since inception:	263
Number of subjects who have consented and enrolled during the last approved period:	91
Number of subjects who withdrew voluntarily during the last approved period:	37
Number of subjects withdrawn by Principal Investigator from study during the last approved period:	0
Proposed number of subjects to be recruited in the coming year:	150

Is this study supported by NIH funds?

No

If any subject was withdrawn or voluntarily withdrew from the study during the last approved period, explain below:

Describe any difficulties encountered in contacting, recruiting, or obtaining the consent of research participants during the last approved period:

None

Describe any complaints about the research received during the last approved period:

None

Describe any serious adverse events, injuries to human subjects, or other unanticipated problems involving risks to subjects or others during the last approved period (include date reported to IRB, if it was not reported explain why):

None.

Do you know of any findings outside of your study, recent literature, or other relevant information, especially about risks associated with the research, during the last approved period? (If yes, please upload documentation)

No

Protocol Information

Please provide a summary/progress report of any study findings from the past year:

For the cohorts that have completed the professional development to date, we have found medium to large effect sizes in principal knowledge of the Next Generation Sunshine State Standards (NGSSS) for mathematics and science as well as medium effect sizes demonstrating increases in the level of teacher engagement in communities of instructional practice.

Have any modifications been made to the protocol, consent form(s), recruitment materials, or other study documents?

Yes

If yes, answer questions below:

What modifications were made since the last IRB review was conducted? (Provide dates approved by IRB. If modification were made without approval, explain why)

The following are changes emailed to Julie Haltiwanger on Dec 18, 2009 for review by the HSC Chair....(We were unable to submit these electronically without completing the entire

IRB application anew). I am resubmitting this information here to ensure that this becomes part of our formal application.

(1) The title of the professional development (funded as a separate project by the Florida Department of Education) has been changed from "Principal PROMiSE" to "Leadership in Mathematics and Science Instruction." We have changed the title of the research project accordingly on the consent forms, but will retain the original research project title, "Principal PROMiSE Research Project," for IRB records and communications.
(2) Separate consent forms (for principals and teacher leaders) have been drafted for treatment and control groups.
(3) The teacher consent form was redrafted as a consent form for teacher leaders participating in the professional development. Financial incentives for teacher leader participation will be awarded only to teacher leaders in the control group (not the treatment group). Also, they will be awarded to individuals, rather than to the school.
(4) Data collection is limited to pre- and post-measures required as part of the professional development project (separate from the research project). Participants will be able to voluntarily choose whether they want these pre-post data to be used as part of our research project.
(5) The in-depth qualitative study has been dropped. If a submitted federal grant application is funded to continue the research project, we will submit new consent forms for IRB approval.
(6) The amounts and timing of incentives for participation have been revised. Only control group principals and teacher leaders will receive financial incentives ($100 after pre-measures are completed).
(7) The list of instruments to be completed by principals has been slightly revised (e.g., the instrument measuring knowledge of science teaching was replaced with a measure of principal expertise in observing mathematics classroom instruction in video vignettes). The RTOP instrument, previously approved by the IRB for use in the qualitative study, will be used for this purpose.
(8) The number of instruments to be completed by teachers (now teacher leaders) has been reduced from 4 to 3. Knowledge of science teaching was deleted.
(9) The provision for sharing participants' individual data with Westat has been dropped. Beginning with this new cohort of principals and teacher leaders, FSU will be administering all data collection instruments, so datasharing will no longer be necessary

What modifications are being proposed at this time?

None

Considering your experience with this study's implementation to date and your review of the relevant recent literature has the relationship between study risks and benefits changed since your last renewal of this project?

No.

Anticipated completion date of the project: 8/31/2011

Consent Form Information

Current participants must be informed about any significant new findings, protocol or consent form changes that might relate to their willingness to continue participation. If any significant new findings, or protocol or consent form changes are described above, please describe how you have informed participants of this information, or how you propose to inform participants of this information.

Was waiver of consent form granted by the IRB?

No

Carefully review your last-approved consent form. Considering the progress, your experience, or any changes in the conduct of this study, is the description of the purpose and procedures, and the disclosi of the risks and benefits, still adequately addressed in the informed consent form?

Yes

Financial Information

Are there changes in any financial interests related to this study or in any conflicts of interest of the PI or a other investigator as defined by University Policy or, if applicable, NIH/NSF policies regarding conflict of interest? (If yes, please upload documentation)

No

Is there any new funding proposed for this study?

Yes

If yes, please describe:

We submitted a proposal to the USED School Leadership Grant program on April 6, 2010

Expired Studies

If your study expires before the date of FSU IRB continuing review approval, all enrollment and data collectior must stop the day after it expires. Procedures and treatment needed for participant safety may continue, but data collection during this time cannot be used for research purposes.

Has the FSU IRB approval expired for this study?

No

HIPAA Compliance

Are you collecting identifiable health information about subjects enrolled or to be recruited after April 14, 2003?

No

Uploaded Documents

- **Click icon to view renewal documents**
  - 2009.2774 Renewal
  - Approval
  - Zip and Download All

Office of the Vice President For Research
Human Subjects Committee
Tallahassee, Florida 32306-2742
(850) 644-8673 Â· FAX (850) 644-4392

RE-APPROVAL MEMORANDUM

Date: 6/12/2009

To: Laura Lang [llang@fsu.edu]

Address: 2540
Dept.: LEARNING SYSTEMS INSTITUTE

From: Thomas L. Jacobson, Chair

Re: Re-approval of Use of Human subjects in Research
Principal PROMiSE Research Project

Your request to continue the research project listed above involving human subjects has been approved by the Human Subjects Committee. If your project has not been completed by 6/9/2010, you are must request renewed approval by the Committee.

If you submitted a proposed consent form with your renewal request, the approved stamped consent form is attached to this re-approval notice. Only the stamped version of the consent form may be used in recruiting of research subjects. You are reminded that any change in protocol for this project must be reviewed and approved by the Committee prior to implementation of the proposed change in the protocol. A protocol change/amendment form is required to be submitted for approval by the Committee. In addition, federal regulations require that the Principal Investigator promptly report in writing, any unanticipated problems or adverse events involving risks to research subjects or others.

By copy of this memorandum, the Chair of your department and/or your major professor are reminded of their responsibility for being informed concerning research projects involving human subjects in their department. They are advised to review the protocols as often as necessary to insure that the project is being conducted in compliance with our institution and with DHHS regulations.

Cc: Laura Lang, Dean [llang@fsu.edu]
HSC No. 2009.2774

Office of the Vice President For Research
Human Subjects Committee
Tallahassee, Florida 32306-2742
(850) 644-8673 Â· FAX (850) 644-4392

APPROVAL MEMORANDUM

Date: 6/17/2008

To: Laura Lang [llang@fsu.edu]

Address: 2540
Dept.: LEARNING SYSTEMS INSTITUTE

From: Thomas L. Jacobson, Chair

Re: Use of Human Subjects in Research
Principal PROMiSE Research Project

The application that you submitted to this office in regard to the use of human subjects in the research proposal referenced above has been reviewed by the Human Subjects Committee at its meeting on 06/11/2008. Your project was approved by the Committee.

The Human Subjects Committee has not evaluated your proposal for scientific merit, except to weigh the risk to the human participants and the aspects of the proposal related to potential risk and benefit. This approval does not replace any departmental or other approvals, which may be required.

If you submitted a proposed consent form with your application, the approved stamped consent form is attached to this approval notice. Only the stamped version of the consent form may be used in recruiting research subjects.

If the project has not been completed by 6/10/2009 you must request a renewal of approval for continuation of the project. As a courtesy, a renewal notice will be sent to you prior to your expiration date; however, it is your responsibility as the Principal Investigator to timely request renewal of your approval from the Committee.

You are advised that any change in protocol for this project must be reviewed and approved by the Committee prior to implementation of the proposed change in the protocol. A protocol change/amendment form is required to be submitted for approval by the Committee. In addition, federal regulations require that the Principal Investigator promptly report, in writing any unanticipated problems or adverse events involving risks to research subjects or others.

By copy of this memorandum, the Chair of your department and/or your major professor is reminded that he/she is responsible for being informed concerning research projects involving

human subjects in the department, and should review protocols as often as needed to insure that the project is being conducted in compliance with our institution and with DHHS regulations.

This institution has an Assurance on file with the Office for Human Research Protection. The Assurance Number is IRB00000446.

Cc: Laura Lang, Dean [llang@fsu.edu]
HSC No. 2008.1392

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BIOGRAPHICAL SKETCH

Kristina N. LaVenia was born June 21, 1970 in Albany, Georgia. She graduated from Florida State University (FSU) with a B.S. in Psychology in 1994, the University of West Alabama with a M.S. in Guidance and Counseling in 2006, a graduate certificate in Measurement and Statistics from FSU in 2009, and her Ph.D. in Educational Leadership and Administration from FSU in 2015. Kristina was an Institute of Education Sciences Predoctoral Interdisciplinary Research Training (PIRT) Program Fellow through the Florida Center for Reading Research and FSU for four years during her doctoral studies. As part of her work in the PIRT program, Kristina became a certified reviewer for the What Works Clearinghouse in 2009. She currently works at Florida State University as an Assistant in Research and her work centers on research and evaluation of teacher professional development programs, with a particular focus on STEM teacher professional development. Her research interests span a variety of constructs related to teaching and learning, and include: professional development for educators, learner motivation and engagement, and understanding how best to help educators, parents, and students overcome barriers to students' academic successes. Kristina is married to Mark LaVenia and has three children – David, Sophie, and Charlie.