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The Perceived Relationship of Leadership Behaviors to Teacher Preparedness for Implementing Connecticut's Core Standards in Mathematics and Use of Math Practices Aligned with Key Shifts in the Common Core

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Angela Rossbach, Ed. D.

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Abstract

This study examines the relationship between specific leadership behaviors (i.e. the extent to which principals establish goals and expectations; plan, coordinate and evaluate teaching and the curriculum; and promote and participate in teacher learning) and teachers' self-reported sense of preparedness and self-reported use of practices that align with the key shifts in the Common Core State Standards in Mathematics (CCSSM). Data for this quantitative study are from a teacher survey that was distributed electronically to all K-8 certified Connecticut teachers in fall, 2015. A total of 2013 surveys were completed by Connecticut teachers who taught mathematics during the 2014-2015 school year, and constitute the analytic sample.

Linear regression analysis shows significant relationships between principal leadership behaviors, teachers' self-reported preparedness to teach the CCSSM, and the extent to which teachers reported using math practices that are aligned with Common Core expectations. Specifically, teachers who reported higher levels of principal involvement in setting clear goals and expectations, and supporting and participating in teacher learning, also reported higher levels of preparedness to teach the CCSSM. Teachers who reported higher levels of principal involvement

in setting clear goals and expectations also reported lower levels of using math practices that are not aligned with the CCSSM. Conversely, teachers who reported higher levels of principal planning, coordinating, and evaluating teaching and the curriculum also reported higher levels of using math practices that do not align with the key shifts in the CCSSM. Finally, teachers who reported higher levels of feeling prepared to teach the CCSSM also reported using math practices that align with the key shifts in the CCSSM, as well as math practices that do not align with the key shifts.

Specific controls were included in the regression models to account for characteristics that might also influence the key relationships of interest. Importantly, the inclusion of control variables for teacher and school demographics did not change the key relationships in the models, thereby reducing concerns that omitted variables might drive the relationships of interest.

Implications of this study and recommendations are provided at the principal, district, and state levels.

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Problem Statement

Standards-based education is one of the most prominent components of current educational reform initiatives across the United States, and is a centerpiece of federal legislation such as the No Child Left Behind Act of 2011 (Hamilton, Stecher, & Yuan, 2008) and the Race to the Top competition (Fletcher, 2010). The Common Core State Standards (CCSS), released in 2010, represent an attempt to shift from individual state standards to a state-led national consensus on the knowledge and skills that all students should master by the end of each grade level (NGA Center & CCSSO, 2010; Porter, McMaken, Hwang, & Yang, 2011a). The adoption of the CCSS by more than forty states provides a national opportunity to systematically improve mathematics instruction and therefore increase the global competitiveness of the American labor force (Cogan, Schmidt & Houang, 2013).

American students have not performed as well on international mathematics assessments as their counterparts in other countries. In fact, key findings from the Organisation for Economic Co-operation and Development (OECD, 2012) indicate no statistical change in U.S. performance compared to other countries in reading, mathematics and science on the Programme for International Student Assessment (PISA) from 2000 to 2012, the years prior to Common Core implementation. The 2012 PISA results indicate particular weaknesses in mathematical skills for American students. Twenty-six percent of 15-year olds failed to reach the 2012 PISA baseline level for mathematics competency, and only two percent of American students reached the highest level (OECD, 2012). However, according to the 2012 PISA report, the Common Core

State Standards in Mathematics (CCSSM) have the potential to yield significant performance gains on PISA and other international assessments in the future.

Despite the initial interest that teachers expressed in adopting the CCSSM (AFT, 2013; Van Roekel, 2014), barriers are evident. First, the short implementation timeline has required teachers to learn a lot in a limited amount of time, often with deficient or absent communication and support from school and district administration (Porter, Fusarelli, & Fusarelli, 2014). Second, although teachers typically take policy directives seriously and work hard to implement them (Firestone, Fitz, & Broadfoot, 1999), implementation failure can occur through honest misunderstandings of policy (Spillane, 2004). Clear communication and support from school and district leaders could lead to more effective implementation in line with the Common Core authors' intentions.

Whether or not the CCSSM reform succeeds in significantly improving American students' global mathematical performance may depend in part on the extent to which educational leaders provide the support and structures that will enable teachers to understand and implement the CCSSM in their instruction in an effective manner. Without an understanding of the key shifts between the CCSSM and previous standards, teachers may fail to increase both the rigor and depth of their instruction, which are key features of the CCSSM (Cogan, et al., 2013).

What can educational leaders do to support teachers so that they feel prepared to teach the standards and use instructional practices aligned with the CCSSM? This study sought to contribute to the growing literature regarding effective implementation of the Common Core Standards by examining the relationship between specific leadership behaviors, as perceived and reported by teachers, to teachers' self-reported preparedness

to teach the CCSSM and their self-reported use of practices related to the CCSSM. For this study, teacher preparedness to teach the CCSSM was defined as the extent to which teachers reported feeling prepared to teach the emphasized grade level standards. Teacher practices were defined as the extent to which teachers reported that they incorporate instructional practices that are related to key CCSSM shifts in instruction.

To build a foundation and to ground my study, I begin with a description of the Common Core State Standards in Mathematics (CCSSM). I then describe the key shifts of the CCSSM from previous standards, since a clear understanding of these shifts can lead to instructional practice that is in line with the Common Core authors' expectations. I proceed with a review of the educational leadership research, paying particular attention to specific leadership behaviors that have been linked to positive school outcomes. This review provides the basis for my conceptual framework, which examined the relationship of specific leadership behaviors to teachers' self-reported preparedness to teach the CCSSM, and self-reported implementation of practices related to the key shifts in the CCSSM. The results of this study will inform educational leaders about the relationship between specific leadership strategies and teachers' self-reported sense of preparedness to teach the CCSSM, and the relationship between the leadership strategies and the extent to which teachers reported that their instructional practices align with the key shifts in the CCSSM from previous standards. This information may provide guidance for school leaders seeking to support teachers with the Common Core implementation process within their schools and districts.

CHAPTER II

Review of Literature

Understanding the Common Core State Standards in Mathematics

The Common Core State Standards were written by the National Governors Association Center for Best Practices and the Council of Chief State School Officers, and were designed to ensure that all students are exposed to rigorous standards that are relevant to the real world so that they are able to graduate from high school prepared for college, career, and life (NGA Center & CCSSO, 2010). The CCSSM build upon previous mathematical standards, but include significant instructional shifts for many teachers (Porter, et al., 2011a; Cogan et al., 2013; Dacey & Polly, 2012).

Historically, mathematics instruction has focused primarily on performing discrete procedures at the expense of understanding mathematical concepts and relationships (Cobb & Jackson, 2011a). Research efforts over the past twenty years have outlined a set of instructional practices that may support students as they build a conceptual understanding of key mathematical concepts (National Council of Teachers of Mathematics, 2000). A central goal of these practices is that learning opportunities are ambitious and equitable for all students, regardless of demographics. In an ambitious vision, teachers support students as they learn to solve real-world problems, articulate their mathematical reasoning, and make connections between their own and others' solutions (NCTM, 2000). The NCTM standards seek to build students' conceptual understanding and procedural fluency, deemed important in decades of research (NCTM, 2000). Unfortunately, large-scale improvement efforts such as this have rarely made a lasting impact on instructional practices (Cobb & Jackson, 2011a), since Mathematics

instruction in the United States has typically focused on surface-level procedures rather than on the in-depth instructional practices proposed by the NCTM (2000).

The CCSSM, like NCTM's *Standards for Mathematics* (2000), seek to build students' conceptual understanding and procedural fluency. However, the emphasis is on building students' flexibility and efficiency with math facts, so that they are better able to focus on the complexities of problem solving rather than on calculations (NGA Center & CCSSO, 2010). In addition, the CCSSM are more focused, coherent, and rigorous than the NCTM standards (NGA Center & CCSSO, 2010). This is to ensure that all students have enough mathematical knowledge to be prepared for college or career by the time they graduate from high school. Rather than teaching a wide range of topics every year, there is a deep focus on the emphasized standards within each grade level so that students can spend time gaining a strong foundation (NGA Center & CCSSO, 2010). Teachers are expected to develop their students' expertise in applying a variety of mathematical practices (e.g. make connections between previous learning and new mathematical understandings, and persevere in solving problems) as they engage with the grade level standards. There is a clear and coherent progression of math skills and concepts across the grade levels, with rigorous new skills and concepts building upon those learned in previous grades (NGA Center & CCSSO, 2010). In order to master each standard, students need time across grade levels to increase their depth of understanding and proficiency (Dacey & Polly, 2012). Therefore, each standard is treated as an extension of previous learning rather than a discrete new learning experience (Common Core State Standards Shifts in Mathematics, n.d.), and supporting topics are linked to the major standards at each grade level. Rigor at each grade level is pursued through a balance of

conceptual understanding, procedural skill and operational fluency, and opportunities to apply knowledge by solving real-world problems (NGA Center & CCSSO, 2010; Common Core State Standards Shifts in Mathematics, n.d.).

Due to these shifts with the Common Core, and historical evidence that ambitious teaching with the NCTM standards did not gain the needed traction, it is possible that there are gaps between teachers' beliefs and practices. As teachers work to understand the new standards, they draw on their previous background knowledge, experience and beliefs, look for connections, and layer the new learning on top of what they previously understood (Weick, 1995; Spillane, 1999). At the outset of implementation across the United States, teachers failed to understand "the extent to which the Common Core Standards for Mathematics are in fact quite *different* from what has gone before, an ignorance due in part to the traditionally fragmented, incoherent character of the U.S. mathematic curriculum" (Cogan et al., 2013, p. 10). At the time of their study, Cogan and his colleagues (2013) found that depending upon the grade level taught, 35-67% of Connecticut teachers did not feel that they were well prepared to teach the standards. In addition, since the names of the CCSSM topics (e.g. number sense, algebraic thinking) remain the same as in the pre-CCSSM curriculum, most teachers did not recognize that instruction with the CCSSM content differs from instruction with previous standards (Cogan et al., 2013). As a result, teachers may believe they understand the CCSSM, but that understanding may not match what the policymakers intended (Spillane, 2004). In order to implement the CCSSM according to the authors' intentions, teachers must feel prepared to teach the grade level focus standards (Cogan, et al., 2013), and develop a

clear understanding of the differences between prior standards and the CCSSM so that their instructional practices align with the new standards (Dacey & Polly, 2012).

For the purposes of this study, teacher outcomes were defined as the extent to which teachers reported (1) feeling prepared to teach the CCSSM that are emphasized at their grade level, and (2) using instructional practices that align with key shifts in the CCSSM regarding focus, coherence and rigor.

Educational leaders may be able to support teachers as they develop a stronger understanding of the CCSSM through their use of specific instructional leadership strategies that have been linked to school improvement (Robinson, Lloyd, & Rowe, 2008; Hallinger, 2011). With a clear understanding of the CCSSM, teachers may provide instruction that is more focused, coherent, and rigorous than with previous standards, and may ultimately improve the performance and thereby the global competitiveness of American students (Cogan, et al., 2013; Porter, et al., 2014).

Leadership Behaviors

Instructional leadership has been researched consistently over the years (Robinson, et al., 2008; Fullan, 2005; Grissom & Loeb, 2011; Hallinger, 2005; Hallinger & Heck, 1998; Hallinger & Murphy, 1985; Leithwood, Seashore, Anderson, & Wahlstrom, 2004; Marks & Printy, 2003; Marzano, Waters, & McNulty, 2005). Originating during the effective schools movement of the 1970's (Edmonds, 1979), instructional leadership theory initially focused exclusively on the relationship of the principal's behaviors to school outcomes. However, this exclusive focus on the principal led to a heroic conceptualization that few were able to attain (Hallinger, 2005). Recent instructional

leadership research is more inclusive, focusing on the behaviors of not only the principal, but of others who are in positions of responsibility such as instructional coaches and curriculum coordinators (Heck, 2000; Marks & Printy, 2003; Robinson, et al., 2008; Spillane, et al., 2004). Although the principal retains primary responsibility as the leader of the school, other formal and informal leaders with the requisite expertise exercise leadership alongside the principal (Marks & Printy, 2003). However, school principals act in a boundary-spanning role, coordinating the efforts of teachers and teacher leaders as they work to advance student achievement. This is a role that is unique to the school principal, and not one that is typically picked up by other leaders within the school (Seashore, Leithwood, Wahlstrom, & Anderson, 2010a; Seashore, Leithwood, Wahlstrom, & Anderson, 2010b). As a result, the role of the principal is pivotal when examining instructional leadership.

Researchers have frequently found a small and indirect relationship between instructional leadership and student achievement (Marzano, et al., 2005; Hallinger, 2005; Seashore, et al., 2010a; Seashore, et al., 2010b), second only to the effect of teachers on student achievement. In a literature review, Hallinger (2005) found that school principals indirectly contribute to student achievement through leadership behaviors that influence school and classroom conditions, such as shaping the school's mission. Leithwood et al. (2004) identified three key practices that successful school principals employ. These practices include: (1) *Setting Directions*, (2) *Developing People*, and (3) *Redesigning the Organization*. Seashore Louis et al. (2010) identified a fourth practice, *Managing the Instructional Program.* These four leadership behaviors form a set of core practices that impact conditions within the school. Taken together, these practices have an important

influence on student outcomes. However, they are not likely sufficient for significantly improving student achievement on their own (Leithwood, et al., 2004). Their influence is strengthened when other variables (e.g. teacher professional communities, reflective discussions about teaching and learning, and a collective sense of responsibility for student outcomes) are present as well (Seashore Louis, et al., 2010).

In a recent meta-analysis of leadership research, Robinson et al. (2008) found stronger links between leadership and student achievement when they used an inductive strategy where leadership survey items were read repeatedly, then grouped together according to meaning to derive five leadership dimensions or behaviors of school principals (see Appendix A). These five leadership dimensions are:

(1) *Establishing Goals and Expectations*,

(2) *Strategic Resourcing*,

(3) *Planning*, *Coordinating, and Evaluating Teaching and the Curriculum,*

(4) *Promoting and Participating in Teacher Learning and Development*, and

(5) *Ensuring an Orderly and Supportive Environment*.

According to Robinson, et al. (2008), this list of dimensions differs from other leadership frameworks such as Leithwood et al. (2004) because there is no distinction between tasks and relationships. Instead, relationship skills are embodied in every dimension. For example, when leaders set goals (a task focus), they must also ensure that staff understand and become committed to the goals (a relationship focus). The fourth dimension in Robinson et al.'s framework (2008), *Promoting and Participating in Teacher Learning and Development,* was most strongly associated with positive student outcomes, with strong average effects (0.84). Moderate effects were observed in the

dimensions concerned with *Establishing Goals and Expectations* (0.42) and *Planning, Coordinating, and Evaluating Teaching and the Curriculum* (0.42). Thus, these three instructional leadership practices were determined to have the strongest links to student achievement.

Hallinger (1990) developed the most frequently studied conceptualization of instructional leadership over the past thirty years. Hallinger's *Principal Instructional Management Rating Scale* (PIMRS) has been used in hundreds of studies over the past three decades to measure principal leadership behaviors. The PIMRS consistently provides a reliable and valid means for measuring the instructional leadership behaviors of school principals (Hallinger, 2005). It consists of three domains: (1) *Defining the school's mission*, (2) *Managing the instructional program*, and (3) *Promoting a positive school learning climate*. Multiple constructs are included within each domain, most of which align with the three leadership behaviors identified by Robinson, et al. (2008) as being strongly or moderately associated with positive school outcomes. Therefore, a closer comparison of Hallinger's PIRMS and Robinson, et al.'s leadership dimensions is in order.

Promoting and Participating in Teacher Learning and Development, the dimension with the strongest effects related to student outcomes (Robinson, et al., 2008), aligns with the function, *Promote Professional Development,* part of the third domain in Hallinger's PIMRS. According to Hallinger (2005), strong instructional leaders align professional development with school goals, and work directly with teachers on improving teaching and learning. Furthermore, Spillane (2004) found that educational

leaders intent on improving instruction within their districts understood the importance of engaging in ongoing learning themselves.

Common Core implementation is subject to failure if educational leaders and teachers do not recognize that CCSSM content is more rigorous than content taught under previous standards (Cogan, et al., 2013). One way that school principals can help teachers to recognize the shifts and adjust instruction is to work directly with teachers and participate in Common Core professional development opportunities alongside their staff. Through this collaborative professional effort, a common language and understanding can be developed, which may support the improvement of teaching and learning related to the CCSSM.

Robinson et al.'s dimension, *Establishing Goals and Expectations,* aligns closely to the first PIMRS domain, *Defining the school's mission.* Effective instructional leaders establish a clear direction for the school and align all strategies and activities to the school's academic mission (Hallinger, 2005; Leithwood, et al., 2004). For example, principals can set clear directions by framing and communicating school goals that are aligned with elements of the Common Core standards, such as ensuring that all students receive instruction that is a balance of conceptual understanding, procedural skill and operational fluency.

Finally, *Planning, Coordinating, and Evaluating Teaching and the Curriculum* (Robinson, et al., 2008), aligns with Hallinger's second domain, *Managing the instructional program.* This domain focuses on both the coordination and supervision of instruction and curriculum (Hallinger, 2005). Effective principals who are deeply immersed in the implementation of Common Core aligned curriculum can support the

development of teachers' understanding by providing feedback through the supervision and evaluation of teaching and learning (Robinson, et al., 2008; Hallinger, 2005).

In this study I examined the leadership behaviors of principals, as perceived by teachers, that are aligned with the three leadership dimensions identified in Robinson, et al.'s meta-analysis (2008) as having strong or moderate effect sizes: *Establishing goals and expectations; Planning, coordinating, and evaluating teaching and the curriculum;* and *Promoting and participating in teacher learning and development.* Since these three leadership dimensions align closely with components of Hallinger's PIMRS, I used constructs from the PIMRS to measure them.

Robinson and her colleagues measured the effect that each leadership behavior had on positive student outcomes. Since the effects of leadership behaviors on student outcomes are mediated by teachers (Hallinger & Heck, 1998), and since teachers' successful implementation of the CCSSM is predicted to improve student achievement (OECD, 2012), it is likely that there is a relationship between leadership behaviors and the extent to which teachers reported an increased understanding of the CCSSM. For example, teachers may have reported feeling more prepared to teach the CCSSM when they reported having principals who participate in professional development alongside them, giving them the opportunity to clarify misunderstandings that may interfere with CCSSM aligned instruction, which in turn may raise teachers' confidence for implementation. Second, teachers may have reported a clearer understanding of the CCSSM shifts, such as the need to have students experience a balance of conceptual and procedural instruction, when they reported having a leader who explicitly frames and communicates school goals that are aligned with the CCSSM shifts. Finally, teachers may

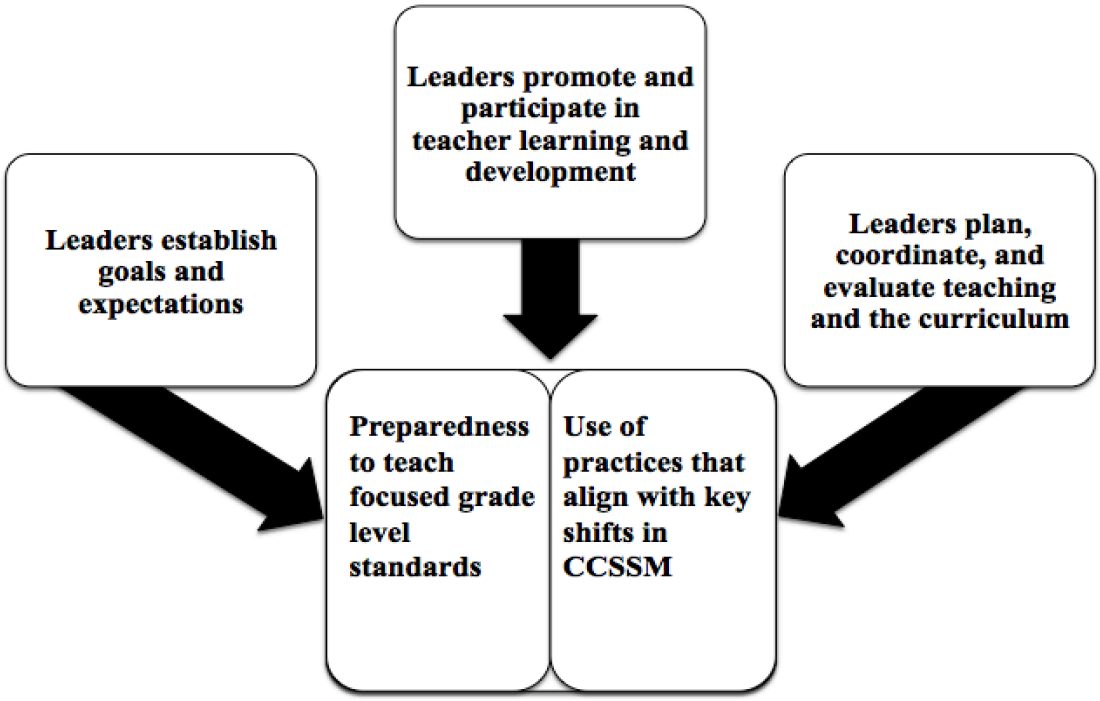
have reported a more comprehensive understanding of the CCSSM when they reported having principals who participate actively in the review of curricular materials and evaluating classroom instruction that is aligned with the CCSSM. Since these leadership behaviors may be related to teachers' understanding of the CCSSM, I measured the relationship between each perceived leadership behavior and the degree to which teachers reported preparedness to teach their grade level's focused standards, and the degree to which teachers reported incorporating key Common Core shifts into their instructional practice.

CHAPTER III

Conceptual Framework

The conceptual framework for this study examines the relationship between three specific leadership behaviors and teachers' self-reported preparedness to teach the CCSSM, and teachers' self-reported use of instructional practices that align with the key shifts.

Figure 1. Conceptual Framework



In this study, I explored the extent to which teachers' perceived leadership behaviors (Robinson, et al., 2008) were related to teacher development and learning; goals and expectations; and teaching and the curriculum. I also examined the extent to

which teachers reported that they felt prepared to teach the focused standards at their grade level, as well as teachers' self-reported use of instructional practices that are aligned to the major CCSSM shifts around focus, coherence and rigor. The purpose of this study was to determine the relationship between specific leadership behaviors, as perceived by teachers, and the extent to which teachers reported feeling prepared to teach the CCSSM and reported using instructional practices that align with the CCSSM.

Research questions

This study sought to answer the following research questions:

1) Is there a relationship between perceived leadership behaviors (i.e. *Promoting and participating in teacher learning and development; Establishing goals and expectations;* and *Planning, coordinating, and evaluating teaching and the curriculum*), and the extent to which teachers report feeling prepared to teach the emphasized grade level CCSSM?

a) Is there a relationship between the specific perceived leadership behavior, *Promoting and participating in teacher learning and development*, and the extent to which teachers report feeling prepared to teach the emphasized grade level CCSSM?

b) Is there a relationship between the specific perceived leadership behavior, *Establishing goals and expectations*, and the extent to which teachers report feeling prepared to teach the emphasized grade level CCSSM?

c) Is there a relationship between the specific perceived leadership behavior, *Planning, coordinating, and evaluating teaching and the*

curriculum, and the extent to which teachers report feeling prepared to teach the emphasized grade level CCSSM?

2) Is there a relationship between perceived leadership behaviors (i.e. *Promoting and participating in teacher learning and development; Establishing goals and expectations;* and *Planning, coordinating, and evaluating teaching and the curriculum*), and the extent to which teachers report incorporating practices that align with key CCSSM shifts into their practice?

   a) Is there a relationship between the specific perceived leadership behavior, *Promoting and participating in teacher learning and development*, and the extent to which teachers report incorporating practices that align with key CCSSM shifts into their practice?

   b) Is there a relationship between the specific perceived leadership behavior, *Establishing goals and expectations*, and the extent to which teachers report incorporating practices that align with key CCSSM shifts into their practice?

   c) Is there a relationship between the specific perceived leadership behavior, *Planning, coordinating, and evaluating teaching and the curriculum*, and the extent to which teachers report incorporating practices that align with key CCSSM shifts into their practice?

CHAPTER IV

Methodology

The purpose of this study was to empirically test the relationship between perceived leadership behaviors and teachers' self-reported preparedness to implement the core standards in mathematics and self-reported use of practices that align with the shifts in the CCSSM. I hypothesized that there is a positive relationship between the leadership behaviors conceptualized in this study and reported by teachers and teachers' self-reported preparedness and use of practices aligned with the CCSSM, since these leadership behaviors have been linked to positive student outcomes in previous research (Robinson, et al., 2008). Data collection and analysis procedures are provided in the following sections.

Sample/Setting/Participants

All certified Connecticut K-8 public school teachers who taught a subject aligned with the Connecticut Common Core standards in mathematics during the 2014-2015 school year were asked to participate in this study. A database containing the email addresses of 12,090 teachers who reported that they taught at the elementary level or who reported that they taught Mathematics at the middle school level was obtained from the Connecticut State Department of Education in April, 2015. An invitation to complete a Common Core implementation survey was sent to all 12,090 teachers in the database. Of these, 373 emails bounced, and an additional 590 teachers reported that they did not teach a subject aligned with the CCSSM in the state of Connecticut during the 2014-2015 school year. Of the remaining 11,127 teachers, 2641 (23.7%) started the survey. In all,

2,013 (18%) fully completed the items related to the independent and dependent variables, and were included in the analysis.

Data Collection

The Common Core survey was administered electronically. In order to strive for a 50% participation rate, I used several strategies for tailored surveys (Dillman, Smyth, & Christian, 2009). An email was sent to all 12,090 potential participants, with a link to the survey on Qualtrics. To establish the benefits of participation, I described how the survey could potentially benefit teachers by providing school leaders with information on how best to support teachers as they learn and fully implement the CCSSM. I also thanked teachers for their anticipated participation. As an incentive and to thank them for their valuable time, participants were offered the chance to enter a raffle for one of three $100 Amazon gift cards upon completing the survey (Dillman, et al., 2009). In order to decrease the perceived costs of participating, I made the online survey convenient to access, formatted to be accessible by computer or smartphone. I also kept the survey as short as possible, with most respondents finishing within 5-10 minutes. Although control variables including teaching role, age, gender, race, and years of experience were requested and included in the report, no other personally identifiable information was collected or reported. In addition, assurances were made that no personally identifiable information would be shared with anyone at any time. In order to establish trust, participants were informed that their email addresses were obtained from the Connecticut State Department of Education. A follow-up email was sent to non-responders one week later. A second reminder was sent one week after that, with a request to include their

voice in this statewide survey. A final reminder was sent four days later, reminding teachers that there were only three days left to have their voices heard before the survey window closed (Dillman, et al., 2009).

Data Measures and Variables

Table 1

Variables

Name	Type	Description	Source
Leadership Behaviors	Independent	Items measure: (1) promoting and participating in teacher learning and development; (2) establishing goals and expectations; (3) planning, coordinating, and evaluating teaching and the curriculum	PIMRS (Hallinger, 1990; 2014) – each set of questions was averaged, according to a five-point Likert scale, to measure the three leadership constructs: IV1 (5 questions), IV2 (5 questions), IV3 (7 questions)
Preparedness to teach the CCSSM	Dependent	Items measure: (1) Self-reported preparedness to teach focused grade level standards; measured with questions adapted from Common core Teacher Survey that asks the teacher to indicate how well prepared they feel to teach each focused standard.	Common Core Teacher Survey (Cogan, L., Schmidt, W. H., & Houang, R., 2013) – a list of 10 standards for each of 9 grade levels was adapted to measure DV1.
Practices that relate to the CCSSM	Dependent	Items measure: (2) Reported frequency in which practices that relate to CCSSM shifts in focus, coherence, and rigor were used; measured with questions from the Common Core Feedback Tool that	Common Core Feedback Tool from Educational Delivery Institute (Common Core Feedback Tool, n.d.) – 5 questions were adapted to measure DV2.

	indicate the self-reported extent to which teachers incorporate specific practices (some of which align with shifts; some of which do not align with shifts.)	
Controls	Gender, race, age, certification, school setting, years of teaching, teaching role	Researcher-developed

Note. Principal components analysis was used to establish that all three sets of questions measured a single independent variable with internal reliability of alpha>.9. Weights from the principal component analysis suggested that simply averaging across items in each set was appropriate.

Survey questions were adapted from existing surveys. Survey questions (see Appendix B) about the extent to which teachers reported feeling well prepared to teach the grade level standards emphasized in the CCSSM were adapted from the National Survey conducted by Cogan, et al., (2013). To obtain an indication of how aligned instruction is to the focus standards, and how prepared teachers feel to teach grade level CCSSM topics, teachers were presented with a list of CCSSM topics appropriate to the grade level that they taught during the 2014-2015 school year (Cogan, et al., 2013). They were asked to report the extent to which they felt prepared to teach each grade level standard. Questions about the extent to which teachers recognize the key Common Core shifts (i.e. focus, coherence, and rigor) were adapted from the Common Core Feedback Tool from the U.S. Education Delivery Institute (n.d.). Responses across questions regarding the first dependent variable about preparedness to teach the focused standards had an alpha/reliability score over 0.90, and were combined to form a single continuous average (Agresti & Finlay, 2009) for each outcome in the conceptual framework. The

questions regarding the second dependent variable about key shifts in CCSSM instruction had an alpha/reliability score of 0.52. Therefore, instead of averaging these questions into a single outcome variable, each question was analyzed separately.

Questions from Hallinger's (1990; 2014) PIMRS (short and long forms) were used to measure teachers' perceptions of the extent to which they experienced the specific leadership behaviors described in the conceptual framework. Although there are three parallel forms of the PIMRS instrument that have been developed and tested, including a form for principals to complete, the form that solicits teachers' perceptions about their principal's behaviors provides the most valid data (Hallinger, 2011). Because the PIMRS instrument does not match directly to the three selected dimensions of leadership from Robinson et al.'s (2008) meta-analysis, the following aggregation was used: The dimension with the strongest effects, *Promoting and Participating in Teacher Learning and Development*, was measured using all five questions from one function of the third dimension in the original full length PIMRS: Promoting Professional Development. *Establishing Goals and Expectations* was measured using five questions about the first dimension from the short form of the PIMRS: Defining the School Mission. Finally, *Planning, Coordinating, and Evaluating Teaching and the Curriculum* was measured using seven questions about the second dimension on the short form of PIMRS: Managing the Instructional Program. Each question was measured using a five-point Likert scale. The responses across questions but within substantive constructs were combined to form an overall average for each predictor in the conceptual framework. All three leadership dimensions had alpha/reliability scores above 0.90.

Data Analysis

For both research questions, multiple linear regression was used to test the relationship between the independent and dependent variables. To address the first question, teachers' self-reported preparedness to teach the CCSSM was regressed on the three leadership behavior variables. A similar approach was used to address the second question. However, rather than use a composite measure of the CCSSM shifts, each question was separately regressed onto the three leadership behavior variables. This decision was made in response to the fact that the five questions about the CCSSM shifts had a reliability/validity score of 0.52 and therefore could not be used as a reliable single outcome. In order to address potential concerns that the associations I estimated were not driven by omitted variables, statistical controls for school level variables (e.g. age, gender, race, district, school, role, experience in current role, experience at current school, length of time working for current principal) were included in the analysis. I employed the following regression models:

Research Question 1:

$$\text{PREPAREDNESS} = ß_0 + ß_1\ \text{LEARNING} + ß_2\ \text{GOALS} + ß_3\ \text{CURRICULUM} + ß_4\ \text{GENDER} + ß_5\ \text{RACE} + ß_6\ \text{AGE} + ß_7\ \text{CERTIFICATION} + ß_8\ \text{SCHOOL SETTING} + ß_9\ \text{YEARS OF TEACHING} + ß_{10}\ \text{TEACHING ROLE} + \varepsilon$$

Research Question 2:

$$\text{PRACTICES} = ß_0 + ß_1\ \text{PREPAREDNESS} + ß_2\ \text{LEARNING} + ß_3\ \text{GOALS} + ß_4\ \text{CURRICULUM} + ß_5\ \text{GENDER} + ß_6\ \text{RACE} + ß_7\ \text{AGE} + ß_8\ \text{CERTIFICATION} + ß_9\ \text{SCHOOL SETTING} + ß_{10}\ \text{YEARS OF TEACHING} + ß_{11}\ \text{TEACHING ROLE} + \varepsilon$$

where PREPAREDNESS is a continuous composite dependent variable that measures the degree to which teachers feel prepared to teach the focused grade level standards;

PRACTICES is a continuous composite dependent variable that measures the degree to which teachers report incorporating five distinct mathematical practices into their classroom instruction;

LEARNING is a continuous composite independent variable that measures teachers' perceptions of the degree to which their principal promotes and participates in teacher learning and development;

GOALS is a continuous, composite independent variable that measures teachers' perceptions of the degree to which their principal establishes goals and expectations;

CURRICULUM is a continuous composite independent variable that measures teachers' perceptions of the degree to which their principal plans, coordinates and evaluates teaching and the curriculum;

GENDER is a categorical dichotomous control variable;

RACE is a categorical nominal control variable;

AGE is a categorical ordinal control variable;

CERTIFICATION is a categorical nominal control variable that reports teacher certification type;

SCHOOL SETTING is a categorical nominal control variable that reports urban, suburban or rural;

YEARS OF TEACHING is a categorical ordinal control variable that reports number of years worked as a teacher in the state of Connecticut;

TEACING ROLE is a categorical nominal variable that reports current role as classroom teacher, teacher leader or coach, special education teacher, instructional support teacher, or other.

I expected to find a significantly positive relationship between the extent to which teachers reported that their principals engaged in the three leadership behaviors (i.e. promotes and participates in teacher learning; establishes goals and expectations; and plans, coordinates, and evaluates teaching and the curriculum) and the extent to which teachers reported that they are prepared to teach the CCSSM. I also expected to find a significant relationship between the three leadership behaviors and the extent to which teachers reported that they incorporate specific mathematical practices into their instruction. I expected to find a significant relationship between the extent to which each leadership behavior was reported and the extent to which teachers reported incorporating two instructional practices that align with the CCSSM (i.e. making connections between previous learning and new mathematical understandings; and dedicating class time to developing procedural skill and fluency). I expected to find a significant relationship in the opposite direction between the extent to which each leadership behavior is reported and the extent to which teachers reported incorporating three instructional practices that are not aligned with the CCSSM (i.e. having students practice mnemonics; exposing students to a wide range of math topics; and teaching students discrete procedures and clues to solve math problems).

Validity and Limitations

The results of this study depended upon responses to an online survey. The validity of the inferences I wished to make (Agresti & Finlay, 2009; Dillman, et al.,

2009) depended upon how accurately the survey items measured the constructs within the conceptual framework as well as how well the respondents represented the larger population of interest. Internal validity could have been affected due to omitted variables for which I cannot account in my model. For example, there may be teachers who are more motivated to gain an understanding of the CCSSM than others due to traits and experiences that are not measured in this study. Control variables were included in order to reduce the effect of some of these omitted variables. Importantly, the coefficients for the three independent variables changed very little when the control variables were included in the regression models, which indicates that the control variables don't change the key relationships of interest and reduce concerns that omitted factors might drive the relationships of interest. Specifically, the relationship persisted even after controlling for teacher and school demographics.

There were also limitations to this study. Leadership behaviors and teachers' understanding of CCSSM were measured as perceived by individual teachers. Therefore, the findings in this proposed study depended upon how honestly and accurately teachers responded to the questions, and whether or not teachers interpreted the questions as intended. In addition, rather than collecting proximal data from principals, teachers were asked to recollect and report on their principal's behaviors. Findings were based on Likert-scale items, which did not allow respondents to construct their own responses or for the researcher to probe for further information (Dillman, et al., 2009). Finally, non-response bias could have been a limitation. The response rate of 23.7% posed some concerns. Although 12,090 surveys were sent, 373 emails bounced, and 590 teachers reported that they did not teach math, leaving 11,127 in the survey population. Of these,

5,624 emails were opened. It is impossible to know how many of the remaining surveys went to a spam account, how many did not pass through school filters, and how many were deleted without being opened by teachers. It is also impossible to know how many additional teachers do not teach math, and therefore did not open the survey. However, of the 5,624 surveys opened, 2641 (47%) started the survey and 2184 (39%) of those who opened it completed all items related to the independent and dependent variables. Some of the response bias may have been reduced by using the gift card raffle incentive and the varied messages on the reminder emails. The potential knowledge gathered from this new area of research makes this study valuable and worthwhile despite the limitations and threats to validity.

CHAPTER V

Findings

The central purpose of this study was to determine if there is a relationship between perceived principal behaviors and teachers' self-reported sense of preparedness and self-reported use of practices that align with the key shifts in the CCSSM. The answer, for the most part, is *yes*, there is a relationship between perceived principal behaviors and teacher behaviors in response to the CCSSM.

There is a statistically significant relationship between two leadership behaviors (i.e. Goals - the extent to which teachers report that the principal establishes academic goals and expectations; and Learning - the extent to which teachers report that the principal promotes and participates in teacher learning and development) and teachers' feelings of preparedness to teach the CCSSM. However, when controlling for other characteristics, there is no statistically significant relationship between the extent to which teachers reported that their principal is engaged in planning, coordinating, and evaluating teaching and the curriculum and the extent to which teachers reported that they feel prepared to teach the CCSSM.

The relationship between perceived leadership behaviors and the frequency with which teachers reported using specific instructional practices is more complex. The extent to which teachers reported that their principals set clear goals and expectations was related to the extent to which teachers reported diminished use of specific practices that are <u>not</u> aligned with the CCSSM (i.e. teaching mnemonics; and teaching students discrete procedures and clues to solve math problems). Teachers who reported higher levels of principal engagement in planning, coordinating, and evaluating teaching and the

curriculum also reported higher levels of devoting class time to helping students develop procedural skills and fluency, a practice that is aligned to the CCSSM. However, teachers who reported higher levels of principal engagement in evaluation and curriculum work also reported higher levels of engagement in practices that are not aligned with the CCSSM (i.e. teaching mnemonics; exposing students to a wide range of math topics within each grade level; and teaching students discrete procedures and clues to solve math problems). The extent to which teachers reported that their principal promoted and participated in teacher learning was not significantly related to the extent to which teachers reported that they engaged in any math practices related to the key shifts in the CCSSM.

In summary, the first principal behavior (1) establishing goals and expectations--is significantly related to lower levels of teachers' self-reported use of practices that do not align to the CCSSM, while the second principal behavior, (2) planning, coordinating, and evaluating teaching and the curriculum is significantly related to higher levels of teachers' self-reported use of practices that do not align with the CCSSM. The second principal behavior, (2) planning, coordinating, and evaluating teaching and the curriculum is also significantly related to higher levels of teachers' self-reported use of one practice that is aligned with the CCSSM (i.e. dedicating class time to helping students develop procedural skill and fluency). The third principal behavior, (3) promoting and participating in teacher learning, is not statistically related to teachers' self-reported use of CCSSM aligned practices.

Is there a relationship between perceived leadership behaviors and the extent to which teachers report feeling prepared to teach the emphasized grade level CCSSM?

Table 2 summarizes responses for the first dependent variable, teachers' self-reported preparedness to teach the CCSSM. On average, teachers felt adequately or well prepared to teach the ten grade level standards (Appendix C). Standard 9 at the 3rd grade level, *Measure and estimate liquid volumes and masses of objects using standard units of grams, kilograms, and liters,* had the lowest mean of 3.33, while standard 5 at the 8th grade level, *Graph proportional relationships, interpreting the unit rate as the slope of the graph,* had the highest mean of 4.67. Overall, 8th grade teachers felt most confident, with responses ranging from 4.33 to 4.67 out of a 5 point scale. 3rd, 4th, and 5th grade teachers felt less confident, with ranges of 3.33-4.31, 3.49-3.97, and 3.38-4.01 respectively. This makes sense, considering that there is an increased emphasis on measurement and number sense and operations in Grades 3-6 (Porter, et al., 2011a; Cobb & Jackson, 2011b).

Table 2

Teacher Preparedness to Teach Grade Level CCSSM - Descriptive Statistics

Grade	*n*	*Mean Score Reported for Each Grade Level Standard*										*Range*
How prepared do you feel to teach CCSSM standards to students at your grade level? *1=Very Poorly Prepared; 2=Poorly Prepared; 3=Adequately Prepared; 4=Well Prepared; 5=Very Well Prepared*												
K	65	4.37	4.43	4.35	4.32	4.26	3.92	4.00	3.89	4.25	3.92	3.92-4.43
1	333	4.20	4.02	4.09	3.96	4.05	4.11	4.06	4.22	4.08	3.99	3.96-4.22
2	354	4.14	4.28	3.81	4.15	4.36	4.03	3.82	3.94	3.96	4.04	3.81-4.36
3	337	3.89	4.31	3.76	3.99	3.78	4.12	4.02	3.79	3.33	3.79	3.33-4.31
4	323	3.82	3.97	3.90	3.66	3.80	3.49	3.90	3.97	3.83	3.56	3.49-3.97

5	284	4.01	4.01	3.83	3.75	4.05	3.38	3.61	3.79	3.67	3.95	3.38-4.01
6	173	4.34	4.43	4.27	4.34	3.91	4.08	4.24	4.36	3.85	4.10	3.85-4.43
7	102	3.83	4.29	3.98	4.13	3.99	4.25	4.18	4.33	3.89	3.86	3.86-4.33
8	124	4.55	4.53	4.50	4.57	4.67	4.33	4.64	4.56	4.45	4.49	4.33-4.67

Note: See Appendix C for survey items describing the Grade Level Standards.

Using multiple linear regression, I found that there was a significant relationship between specific leadership behaviors and the extent to which teachers reported feeling prepared to teach the CCSSM (Table 3). In particular, I found that the extent to which teachers reported that their principal (1) establishes goals and expectations that are easily understood by teachers and the school community; or (2) actively supports and participates in teacher learning and development, is significantly related to the extent to which teachers reported that they felt prepared to teach the CCSSM at their grade level. This was true even when controlling for gender, race, age, certification, school setting, years of teaching experience, and teaching role. However, there was not a statistically significant relationship between the extent to which teachers reported that their principal engages in (3) planning, coordinating, and evaluating teaching and the curriculum, and the extent to which teachers reported that they felt prepared to teach the CCSSM.

There is a moderate statistically significant relationship between the principal behavior of establishing school goals and expectations (beta = .106, p = .001) and teachers' self-reported preparedness to teach the CCSSM. This means that teachers who reported higher levels of principals establishing and communicating the school goals and expectations also reported higher levels of preparedness for teaching the CCSSM at their grade level than those who reported lower levels of principals establishing and communicating school goals at their grade level. For every one-point difference in the

extent to which the principal is reported to communicate the school goals, there is a .106 point difference, with a standard deviation of 0.8, in teachers' self-reported preparedness to teach the CCSSM. Teachers may be more likely to feel prepared to teach the CCSSM when their principal clearly communicates school-wide goals that include a focus on the Common Core Standards. Clear goals provide a focus and allow individuals to coordinate their work on achieving the goals (Robinson, et al., 2008). By communicating goals that align with the Common Core, principals may focus teachers' work on learning the CCSSM, thus increasing their sense of preparedness.

There is a moderate statistically significant relationship between the extent to which teachers reported that their principal promotes and participates in teacher learning (beta = .060, p = .038) and the extent to which teachers felt prepared to teach the focused standards. In other words, teachers who reported higher levels of principal support and participation in teacher learning activities also reported higher levels of feeling prepared to teach the CCSSM at their grade level than those who reported lower levels of principal support and participation in teacher learning activities. For every one-point difference in the extent to which the principal is reported to support and participate in teacher in-service activities, there is a .060 difference, with a standard deviation of 0.8, in teachers' self-reported preparedness to teach the CCSSM. This association is intuitive. By participating alongside teachers, the principal may be able to clarify any misunderstandings, thereby ensuring that teachers feel more confident to teach the CCSSM. In addition, the principal may be seen as a leading learner whom teachers go to for instructional advice (Robinson, et al., 2008), making them more likely to influence teachers' self-efficacy for teaching the CCSSM.

However, there is also a possibility that professional development is focused more on learning new math programs than on allowing teachers to gain a clear understanding of the tenets of the CCSSM. For example, in the comment section on the survey, one teacher reported that "I don't know the CCSS off the top of my head, but I know that the math resource we use is very well-aligned. So I know if I teach the resource well, I'll be teaching the CCSS well." Another teacher reported that teachers were struggling with a newly adopted teaching resource that included lots of workbook pages and few hands on activities. Yet another teacher commented, "Teachers need much more time and practice with the new information in order to become more competent. They especially need materials provided to them instead of searching on the internet and not knowing if what they have is of high quality." In these situations, teachers may feel more prepared to teach the CCSSM, but their instruction may not align to the CCSSM as much as they think.

These results support Robinson et al.'s (2008) conclusions that establishing goals and expectations, in addition to promoting and participating in teacher learning and development, are associated with positive school outcomes. On the other hand, the extent to which teachers reported that their principal planned, coordinated and evaluated teaching and the curriculum (beta = -.027, p = .451) was not significantly nor positively related to teacher sense of preparedness to teach the core standards. There may be varying reasons for this. One reason may be that in some school districts, there is a curriculum coordinator who is responsible for coordinating the curriculum across the school and district. Teachers in these districts may report that their principal does not frequently engage in planning and coordinating the curriculum because it is outside his or

her realm of responsibility, but they still feel prepared to teach CCSSM. Alternatively, teachers may not be aware of their principal's engagement in curriculum activities that may happen behind the scenes.

Several notable control variables were significant in this regression model (Table 3). First of all, the extent to which younger teachers (age < 25, and ages 25-34) reported feeling prepared to teach the CCSSM (beta = -.370, p = .002) is significantly less than older teachers (age >54), all other things being equal. This may be a result of the in-depth focus and increased rigor in the CCSSM (NGA Center & CCSSO, 2010). Younger teachers are likely to have fewer years of classroom instruction experience than their older counterparts. This lack of experience may contribute toward younger teachers feeling less prepared to teach the rigorous Common Core standards. Moreover, the extent to which teachers in the role of teacher leader or coach (beta = .214, p = .029) reported feeling prepared to teach the focused standards was significantly higher than classroom teachers. This could be a result of additional training that these teachers may have received, since they are more than likely responsible for providing support to classroom teachers who are learning the core focused standards. Or, teacher leaders and coaches may simply have more confidence in their practice than other teachers. Finally, teachers who work in urban schools (beta = -.138, p = .000) reported lower levels of feeling prepared to teach the CCSSM than teachers who work in suburban or rural settings. Teachers who do not feel prepared to teach in urban schools, which are often culturally and linguistically diverse (Siwatu, 2011), may also be less likely to feel prepared to teach the CCSSM to their students. In addition, urban teachers may be less likely to have the

extent of teaching experience and education that their suburban counterparts may have (Jacob, 2007), which may lead to feeling less prepared to teach the CCSSM.

Table 3

Regression of Preparedness to Teach Focused Standards on Leadership Behaviors

Predictors	*ß*	*t*	*Sig.*
Goals	.106***	3.41	0.001
Curriculum	-.027	-0.75	0.451
Learning	.060**	2.08	0.038
Male	.039	0.72	0.474
Age < 25	-.370***	-3.07	0.002
Age 25-34	-.154***	-2.62	0.009
Urban	-.138***	-3.50	0.000
Rural	.003	0.05	0.960
Coaching Role	.214**	2.18	0.029

Note: Two-tailed significance denoted as *p<0.1, **p<.05, ***p<.01. Responses for peparedness to teach the CCSSM were scored as follows: 1=very poorly prepared; 2=poorly prepared; 3=adequately prepared; 4=well prepared; 5=very well prepared. Responses for the perceived principal behaviors were scored as follows: 1-almost never; 2=seldom; 3=sometimes; 4=frequently; 5=almost always.

Is there a relationship between perceived leadership behaviors and the extent to which teachers report incorporating key CCSSM shifts into their practice?

Table 4 summarizes results for the second dependent variable, the extent to which teachers reported incorporating practices that may or not align to the CCSSM. Note that a lower score reflects more consistent use of the practice in question. On average, teachers consistently teach their students to make mathematical connections (mean = 1.21) and sometimes dedicate time to helping students develop procedural skill and fluency (mean = 1.77). Both of these instructional practices align with the CCSSM. However, teachers also occasionally to sometimes expose their students to a wide range of mathematical

topics (mean = 1.53), which does not align with the CCSSM. Rather than teaching the old "mile-wide, inch-deep" curriculum, the Common Core calls for a focus on fewer standards, which allows students to gain a strong foundation on which to build (Common Core State Standards Shifts in Mathematics, n.d.). To a lesser extent, teachers also reported teaching mnemonics and discrete practices, neither of which aligns with the CCSSM shifts in practice. On average, teachers reported that they *sometimes to rarely* teach mnemonics (mean = 2.43) and *sometimes* teach discrete procedures (mean = 2.10) to students. These are both practices that one would expect to be rarely implemented, since they do not align to the CCSSM.

Table 4

Mathematical Practices Aligned with Key Shifts in CCSSM - Descriptive Statistics

Item	*N*	*Mean*	*SD*
How often do you incorporate the following mathematical practices into your classroom instruction? 1=Consistently, 2=Sometimes, 3=Rarely, 4=Never			
Q10_2 Have students make connections between previous learning and new mathematical understandings. *(A lower score reflects practice aligned with a key shift.)*	2154	1.21	0.444
Q10_3 Dedicate class time to helping students develop procedural skill and fluency in core operations, such as multiplication tables. *(A lower score reflects practice aligned with a key shift.)*	2153	1.77	0.773
Q10_1 Have students practice mnemonics to assist with remembering procedures. *(A higher score reflects practice aligned with a key shift.)*	2069	2.43	0.860
Q10_4 Expose students to a wide range of math topics within each grade level in preparation for their future learning. *(A higher score reflects practice aligned with a key shift.)*	2144	1.53	0.755

Q10_5 Help students learn how to match discrete procedures with math problems and spend time teaching clues and practicing how to match them. *(A higher score reflects practice aligned with a key shift.)*	2146	2.10	1.030

Note: Scores of 5 (= I don't know) were dropped before calculating the descriptive statistics.

Using multiple linear regression, I found that there is a relationship between specific leadership behaviors and the extent to which teachers reported using instructional practices that may or may not align with key shifts in the CCSSM from previous standards (Table 5). Note that for regression analyses, I recoded the outcome variable so that a positive relationship signifies that the reported principal behavior was associated with more frequent use of the instructional practice. In the regression analysis, I found one moderate statistically significant and expected relationship (beta = .100, p = .005) between the extent to which principals are reported to plan, coordinate, and evaluate teaching and the curriculum and teachers' self-reported use of one instructional practice that is aligned to the CCSSM (i.e. dedicating class time to developing procedural skill and fluency). For every one-point difference in the extent to which the principal is reported to plan, coordinate and evaluate teaching and the curriculum, there is an accompanying .100 increase, with a 0.76 standard deviation, in teacher-reported class time dedicated to helping students develop procedural skill and fluency in core operations, such as multiplication tables. However, there is no significant relationship between the extent to which teachers reported that their principal communicates school goals and expectations or the extent to which their principal promotes and participates in teacher learning and amount of class time dedicated to developing procedural skill and fluency. One possible explanation is that principals who engage in curricular work such as

reviewing curricular materials, and reviewing student work samples and discussing student progress with teachers, may be more likely to ensure that their students develop procedural skill and fluency in order to successfully complete CCSSM aligned tasks. Having a principal to interact with about curriculum and student progress may be more important for ensuring that teachers help students to develop procedural skill and fluency than having a principal who communicates the school goals, or participates alongside the teachers in professional development.

Table 5

Regression of Teacher Math Practices Related to Key Shifts in CCSSM on Leadership Behaviors and on Teacher-reported Preparedness to teach the CCSSM

	Key shifts		Not key shifts		
	Q10_2	Q10_3	Q10_1	Q10_4	Q10_5
Goals	-.007	-.056*	-.127***	-.024	-.074***
Curriculum	.024	.100***	.140***	.061**	.141***
Learning	.020	-.006	.038	.036	-.006
Preparedness	.119***	.083***	.047*	.144***	.125***
Male	-.040	-.032	-.151*	-.115**	-.009
Age <25	-.012	.032	.101	-.057	-.080
Age 25-34	-.016	-.044	-.155**	-.072	-.107*
Urban	-.036	.064	.097**	-.059*	.061
Rural	-.022	.134***	.177***	.070	.152***
Coaches	.047	.189*	.095	.026	.077
Spec Ed Teachers	.235	.514*	.950***	.009	.278

Note: Two-tailed significance denoted as *p<0.1, **p<.05, ***p<.01.
Goals, Curriculum, and Learning are Principal behavior predictor variables; Preparedness is a teacher-reported independent variable. The independent variable was recoded so that a positive relationship signifies that the reported principal behavior was associated with more frequent use of the instructional practice.

Table 5 also shows the regression of three instructional practices that are not aligned with the key shifts of the CCSSM (i.e. use of mnemonics; teaching a wide range of math topics; and teaching discrete procedures and clues) onto the three leadership behaviors. I found a statistically significant and unexpected relationship between principals' planning, coordinating, and evaluating teaching and the curriculum and teachers' self-reported use of all three instructional practices that do not align with CCSSM practices, (1) mnemonics (beta = .140, p = .001); (2) wide range of math topics (beta = .061, p = .05); and (3) use of discrete procedures and clues (beta = .141, p = .000). That is, teachers who reported higher levels of principal engagement in evaluating teaching and the curriculum also reported higher levels of use of the three instructional practices that do not align with key shifts in the CCSSM.

Teachers may continue to use practices such as teaching mnemonics, and teaching discrete procedures and clues for solving math problems for various reasons. First, it is possible that these strategies, which were popular prior to the adoption of the CCSSM, are still embedded in the school's curricular materials. It is also possible that teachers reported that they incorporate these instructional practices, even though they are not in congruence with the CCSSM key shifts, because they believe that these practices are appropriate based upon past experiences. One teacher commented, "I have never been a big fan of the Common Core. It's the newest curriculum until the next one comes around. It hasn't really changed the way I teach. I have always challenged my students to think hard, and explain their thought process. I always try to bring varied ways to achieve an answer to reach diversified learners. I still teach the same material, but have introduced more technology into my classroom." As a result, teachers may feel justified in using

strategies such as the teaching of mnemonics and discrete procedures in order to help students achieve mathematics mastery. This may be especially true since test score outcomes are linked to teacher evaluation goals. There may be a perception that tricks such as mnemonics and discrete procedures may help students to perform well on tests.

There are also reasons why teachers might continue to teach a wide variety of topics, despite the fact that the CCSSM includes a focused set of standards at each grade level. As one teacher noted, "Pacing of our common core program is very rushed. Students are expected to demonstrate mastery, yet are given very little time to develop mastery of the standards." One 8th grade teacher reported that the new curriculum was thrown at the teachers and students were not prepared. "Teachers have always said our curriculum was a mile wide and an inch deep, now it's a mile wide and a mile deep. I do think our children need to be challenged and the standards of math raised. But, we can't build on such a shaky foundation. They know a little bit about a lot of topics. The next few years will be a real challenge." Another teacher responded, "To adequately teach the concepts in the Common Core, we must often reach back into curriculum from previous grades in order to get our students ready for new learning. It feels as though the expectation from our administrators is that we can simply start teaching to the common core 'instantly'. We should have a transition guide that gives us 3-4 years to bring students up to the expectations." Another possibility is that teachers who reported higher levels of principal involvement in evaluating teaching and the curriculum are focused on student progress rather than the key CCSSM shifts, since student outcome goals are included in teacher evaluation plans. Teachers may adopt a "whatever it takes" attitude to improve student outcomes, which may include covering a wide array of topics in an

effort to make sure that students have been exposed to everything that might appear on high stakes assessments. Over time, once students have transitioned to the CCSSM, teachers may not feel the need to use strategies that do not align to the CCSSM.

In contrast to these relationships, I found a significant relationship (Table 5) between the frequency with which teachers reported that their principal establishes goals and expectations and the extent to which teachers limit their use of practices that are not aligned with the CCSSM. Specifically, I found a significant relationship for two of the three instructional practices: (Q10_1) have students practice mnemonics (beta = -.127, p = .000); and (Q10_5) help students learn discrete procedures and clues to solve math problems (beta = -.074, p = .035). Teachers who reported that their principals set goals are less likely to report that they use these outdated practices. One possible reason is that principals who clearly communicate goals and expectations may be more likely to identify goals that are related to the key CCSSM shifts in practice. Another possibility is that if goals regarding the CCSSM expectations are communicated clearly to the school community, parents may be more understanding and supportive of teachers' efforts, making teachers feel less pressure to teach using outdated practices. For example, one teacher surmised, "I feel parents are misinformed and also are uneasy about these changes, which therefore contributes to the negative feedback regarding Common Core. If the State and districts took opportunities to explain Common Core more to parents, I believe the connotation associated with Common Core would be more positive. Our students can do what we ask them to, despite it being different than what they have been asked to do in the past. I've seen it happen and therefore this provides me validation that Common Core is an effective shift in Education." Another teacher commented, "One of

our greatest challenges is getting parents on board. The students do not have support at home because this is all new language to their parents." Principals who clearly communicate goals and expectations may be helping to build support from parents for the work that their children are being asked to do. In turn, teachers may feel less pressure from parents to teach mathematics using outdated practices that parents may be familiar with.

There are several notable differences in responses among the control variables in this regression model (Table 5) as well. First of all, the extent to which teachers reported that they felt prepared to teach the Common Core was significantly related to the extent to which teachers reported implementing the two instructional practices that are in alignment with the CCSSM (1) having students make connections (beta = .119, p = .000), and (2) dedicating class time to developing procedural skill and fluency (beta = .083, p = .000). The Common Core guidelines (Common Core State Standards Shifts in Mathematics, n.d.) advise that building connections between previous learning and new mathematical connections (Q10_2) are necessary to build coherence among the grade levels. In addition, developing students' procedural skill and fluency (Q10_3) is necessary so that students will be able to access more complex concepts and procedures (Common Core State Standards Shifts in Mathematics, n.d.).

Interestingly, the extent to which teachers reported that they felt prepared to teach the Common Core was also significantly related in an unexpected direction to the extent to which teachers reported implementing the two instructional practices that are <u>not</u> in alignment with the CCSSM. Specifically, the extent to which teachers reported that they felt prepared to teach the CCSSM was related to the extent to which they exposed

students to a wide range of topics (beta = .144, p = .000), and helped students learn how to match discrete procedures to math problems (beta = .125, p = .000). It could be that teachers believe they are more prepared to teach the CCSSM because they have access to multiple instructional practices – those that align with the CCSSM as well as old practices that they still may find useful. On the other hand, teachers may simply feel prepared to teach the CCSSM because they believe the new standards differ very little from previous mathematical standards.

The second notable control variable shows that males reported lower levels than females of using two of the three instructional practices that are not aligned with the CCSSM (Table 5). The males in this study reported lower frequencies than the females of having students practice mnemonics (beta = -.151, p = .015), and of exposing students to a wide range of math topics within each grade level (beta = -.115, p = .014). There was no significant difference between the extent to which males or females reported teaching discrete procedures and clues to students. Further analysis of this variable is needed to understand why this relationship exists. Only 12% of the respondents in this survey were male, so perhaps the male teachers included in this study have a deeper conceptual understanding of how to teach mathematics than their female counterparts. Alternatively, female teachers may be taking a "try everything" approach to get increased student outcomes. Another possibility is that the male and female teachers vary significantly by age, which could be driving the use of certain practices. Finally, there are typically more female teachers at the elementary level and more male teachers at the middle school level. It could be that middle school teachers, who are also more likely to be males, are more likely to teach a focused set of standards in depth, while elementary teachers do not. In

addition, middle school teachers may be less likely to use mnemonics to teach their grade level standards.

The third notable control variable showed that teachers age 25-34 reported lower levels (beta = -.155, p = .020) than teachers older than 54 of having students practice mnemonics (Q10_1). This may be a result of recent pre-service teacher preparation, which may have focused on conceptual understanding, procedural skill and fluency, and problem solving rather than on the use of mnemonics to solve mathematical problems. There could also be a higher percentage of males in the younger age categories. If this is the case, then there could be an age and gender relationship, which would explain why males and younger teachers are less likely to teach mnemonics than females and older teachers.

Fourth, teachers in both an urban setting (beta = .097, p = .030) and in a rural setting (beta = .177, p = .003) reported higher levels of teaching students mnemonics, a practice that is not aligned to the CCSSM, than teachers in a suburban setting. Rural teachers also reported higher levels of teaching discrete procedures for problem solving (beta = .152, p = .008), a practice that is not aligned to the CCSSM, than teachers in a suburban setting. Urban and rural teachers may be more likely than suburban teachers to feel pressure for improved student outcomes, and therefore may resort to a bag of tricks that includes teaching mnemonics.

A final notable control variable showed that special education teachers reported higher levels (beta = .950, p = .006) than classroom teachers of having students practice mnemonics (Q10_1) to assist with remembering procedures. This could be a result of the needs of the children that the special education teacher is working with. In order to

improve scores, some children with learning disabilities may be taught mnemonics specifically in order to help them remember how to solve CCSSM problems.

Discussion

In this study, I found statistically significant associations between three perceived principal behaviors (i.e. establishing goals and expectations; planning, coordinating, and evaluating teaching and the curriculum; and promoting and participating in teacher learning) and teachers' self-reported implementation of the CCSSM (i.e. preparedness to teach the focused grade level standards; and extent to which specific mathematical practices are incorporated into classroom instruction).

Establishing Goals and Expectations

The extent to which teachers reported that their principal develops goals and expectations that are easily understood and used by teachers in the school, and that are communicated effectively to members of the school community, is significantly associated with the extent to which teachers reported that they felt prepared to teach the CCSSM. The extent to which teachers reported that their principal establishes clear goals and expectations is also significantly associated to the extent to which teachers reported that they are less likely to use specific practices (i.e. mnemonics and discrete procedures) that are not in alignment with the key shifts in the CCSSM.

By communicating clear goals and expectations, principals can focus and coordinate the work of teachers (Robinson, et al., 2008). Principals who clearly articulate school goals and expectations that align with the CCSSM key shifts, such as the need to develop conceptual understanding rather than rely on tricks such as mnemonics and

discrete procedures may focus teachers' work on these areas. It is not only the clear communication of goals, but also the content of those goals, that is important for instructional shifts to occur (Leithwood & Jantzi, 2006). In addition, by clearly communicating goals and expectations regarding the CCSSM to the community, parents may be more understanding and supportive of instructional strategies aligned with the Common Core. This would allow teachers to feel less pressure to use strategies that are not aligned to the CCSSM, such as the mnemonics and discrete procedures.

Planning, Coordinating and Evaluating Teaching and the Curriculum

Teachers who reported that their principal plans, coordinates, and evaluates teaching and the curriculum were also likely to report that they dedicate class time to helping students develop procedural skill and fluency, a practice that is aligned with the CCSSM. However, teachers who reported that their principal was actively involved in planning, coordinating and evaluating teaching and the curriculum by reviewing student work products and other performance measures to assess progress toward school goals, and by using those results to make curricular decisions were also likely to report that they implement practices that are not in alignment with the CCSSM. Specifically, teachers were likely to report that they teach mnemonics, expose students to a wide range of topics, and help students to learn discrete procedures and clues for solving math problems.

It is possible that some teachers have not changed their instructional practices, despite having new curriculum and instructional resources provided by school leaders. It could also be that by using student outcome measures to evaluate teaching, student work, and to make curricular decisions, principals put pressure on teachers to improve student

outcome results. Again, "whatever it takes" strategies may be employed, which means that teachers may resort to practices that do not align with the CCSSM in an effort to achieve immediate results.

Promoting and Participating in Teacher Learning

The extent to which teachers reported that their principal promotes and participates in teacher learning is significantly associated with the extent to which teachers reported feeling prepared to teach the CCSSM. Teachers and principals who learn alongside each other develop a common language regarding their learning. The principal participates in the learning as both a leader and a learner (Robinson, et al., 2008). Learning may take place in formal professional development opportunities, but may also take place in informal staff discussions about teaching and learning. These extended opportunities to learn and discuss the CCSSM together may lead to teachers feeling more prepared to teach the CCSSM.

Teacher Preparedness to Teach the CCSSM

The extent to which teachers reported that they felt prepared to teach the CCSSM was significantly associated with the extent to which teachers reported that their principal sets clear goals and expectations, and supports and participates in teacher learning. Teachers who reported that they are more likely to feel prepared to teach the CCSSM were also significantly more likely to report that they implement four instructional practices – two of which align with the CCSSM, and two of which that do not align with the CCSSM.

Teachers may be more likely to report feeling prepared to teach the CCSSM when they have a toolbox of strategies that includes practices aligned to the CCSSM as well as practices not aligned to the CCSSM, such as the use of discrete strategies for getting the right answer, even when conceptual understanding is not strong. Teachers may also be more likely to report feeling prepared to teach the CCSSM because they believe that they have strategies to fill in the gaps during the transition to the Common Core.

Finally, teachers may report feeling prepared to teach the CCSSM because they have made sense of the core standards in light of what they understood about previous standards (Spillane, et al., 2002). Instead of recognizing the differences between the CCSSM and previous standards, teachers may look for similarities. For example, previous standards focused on ambitious teaching, with the goal of having all students access quality curriculum, learn to solve real-world problems, articulate their mathematical reasoning, and make connections between their own and others' solutions (NCTM, 2000). Teachers may recognize the similarities between the previous math standards and the CCSSM, and believe that they are prepared to use mathematical practices that are in alignment with the CCSSM.

CHAPTER VI

Significance of Study

This study builds upon and connects previous research about the impact of leadership behaviors on student achievement to teachers' understanding of the Common Core State Standards in Mathematics. Previous research shows that specific leadership behaviors have a small but significant effect on student outcomes (Hallinger & Heck, 1998; Marzano, et al., 2005; Hallinger, 2011; Robinson, et al., 2008). However, little is known about the effect of specific leadership behaviors on teachers' feelings of preparedness to implement curricular reform, and on their ability to implement curricular reform according to policy makers' intentions. Although there have been national studies about teachers' understanding of the CCSSM (Cogan, et al., 2013; Porter, et al., 2014) there are no studies that explore the relationship between perceived leadership behaviors, teachers' self-reported preparedness to teach the CCSSM, and the extent to which teachers' instructional practices align with the key shifts in the CCSSM. This is the first study of Connecticut public school teachers who have taught mathematics aligned to the Common Core State Standards in Mathematics, and the first study in the nation that examines the relationship between perceived leadership behaviors and teachers' self-reported implementation of the CCSSM.

In this era of high accountability emanating from multiple reforms at the federal and state levels, principals and other school leaders can benefit by understanding the relationship between perceived leadership behaviors and teachers' self-reported understanding of the Core Standards. The results of this state-wide study will inform

school leaders at the state, district, and school level of the specific leadership behaviors that have a statistically significant relationship with teachers' reported understanding of the CCSSM, and provide guidance for principals and other school leaders who wish to strengthen teachers' understanding of the Core Standards in particular and reform messages in general. In addition, the results of this study are generalizable to other states that are implementing the CCSSM under similar circumstances.

The results of this study could inform policy makers by providing initial insight into the leadership behaviors that seem most important for supporting teachers in reform implementation. This understanding could result in less emphasis on external mandates and sanctions, and more emphasis on ensuring the structures and leadership supports that will enable teachers and principals to thoroughly understand the reform in a manner consistent with policymakers' intentions.

Implications

This study has implications for practice and future research in school administration and teacher preparation for learning and implementing new standards. In addition to implications for teachers and principals, this study provides guidance for district and state leaders.

Principal Implications

Principals have many responsibilities, including instruction management, organization management, internal and external relations, and administration (Grissom & Loeb, 2011). For those who are looking for ways to focus their valuable time to ensure that teachers feel prepared to teach the common core and use instructional practices that

are aligned with the CCSSM, principals can focus first on setting clear goals and expectations for teachers and the school community, since setting goals and expectations was the only principal behavior that was significantly and positively related to both of the teacher outcomes. Specifically, principals can communicate goals and expectations that clearly align to the Common Core shifts. For the CCSSM, principals should articulate goals regarding the need to focus student instruction on fewer topics, to delve deeply into the major works specified in the grade level standards, and to help students to make connections between previous learning and new mathematical concepts. In addition, principals can share expectations that classroom instruction should build students' conceptual understanding, procedural skills and fluency, and provide opportunities for students to apply their learning (Common Core State Standards Shifts in Mathematics, n.d.).

If principals want to ensure that teachers understand the goals they communicate regarding the CCSSM, and use instructional strategies that are in alignment with the key shifts, professional development should be focused on the Common Core shifts as well as on Common Core aligned teaching resources. In this study, the extent to which teachers reported that their principal promoted and participated in teacher learning was significantly related to the extent to which teachers reported feeling prepared to teach the CCSSM. However, teachers who reported higher levels of feeling prepared to teach the CCSSM also reported higher levels of using practices that align with key mathematical shifts in the Common Core as well as higher levels of using practices that do not align with the key mathematical shifts.

Through varied professional development opportunities (Hodkinson & Hodkinson 2005; Cobb & Jackson, 2011a), teachers can build an understanding of the key shifts called for in the Common Core, enabling them to make professional decisions on how to provide instruction that is rigorous, coherent and focused on the key standards rather than on a wide variety of topics at each grade level. By participating in and supporting teacher learning, principals can help teachers to build their understanding of the mathematical practices aligned with the Common Core, and to make professional decisions regarding which mathematical practices to incorporate into classroom instruction.

In addition, principals should ensure that as they plan, coordinate, and evaluate teaching and the curriculum, they emphasize the importance of teaching and learning that is aligned with the key shifts in the CCSSM rather than putting an overemphasis on results right away. In this study, the extent to which teachers reported that their principals planned, coordinated and evaluated teaching and the curriculum was significantly related to the extent to which teachers reported using practices that align with the CCSSM (i.e. developing procedural skill and fluency) as well as using practices that do not align with the CCSSM (i.e. teaching mnemonics; teaching a wide range of topics; and teaching discrete procedures). If student results become the main emphasis, teachers may resort to old mathematical practices such as the use of mnemonics and discrete procedures in order to boost test scores (Booher_Jennings, 2005; Au, 2007). Instead, principals should emphasize using practices that allow students to develop deep understandings and connections among a narrow set of mathematical topics. Before providing teacher feedback after walkthroughs and observations, principals should make sure that they themselves fully understand the shifts in the CCSSM. Then, principals can take note of

mathematical practices that are not in alignment with the CCSSM, and provide specific recommendations on ways teachers can learn to adjust their practice so that students develop a deep conceptual and procedural understanding of math topics. For example, teachers with varying backgrounds and years of experience could be asked to collaboratively explore authentic ways to build students' connections and procedural skill and fluency. As a result, teachers could use their strengths to support one another. For example, younger teachers who reported that they are less likely than their older colleagues to use the outdated strategy of teaching mnemonics may be able to offer other suggestions for instructional practices that are more in alignment with the CCSSM. On the other hand, older teachers who reported that they feel more prepared to teach the CCSSM may provide suggestions that will build younger teachers' confidence and feelings of preparedness.

District Implications

This study also provides guidance for district leaders as they provide support for principals and teachers. First of all, district leaders may want to establish clear goals and expectations regarding Common Core implementation, and encourage principals to do the same at the building level. When clear goals and expectations are set, teachers are more likely to report feeling prepared to teach the CCSSM, and less likely to report using instructional practices that do not align with the CCSSM. Rather than focusing primarily on growth as measured by assessments, goals could also focus on the development of teaching practices that are aligned to the Common Core. For example, district and school goals might center on improvement in the key shifts in the CCCSM (e.g. greater focus on fewer topics, building connections between mathematical topics, increased procedural

skill and fluency, and application of mathematical knowledge to solve problems) rather than placing a heavy emphasis on test scores.

In addition, district leaders may want to evaluate the extent and quality of Common Core professional development that is offered to teachers and school leaders. Teachers who reported higher levels of preparedness to teach the CCSSM also reported higher levels of using math practices that align with the CCSSM as well as using math practices that do not align. Additionally, teachers who reported higher levels of preparedness to teach the CCSSM also reported higher levels of principals promoting and participating in teacher learning. Hence, teachers and their principals may not all be as well-versed in the focused grade level standards and the key shifts in CCSSM practice as they think they are.

Therefore, district leaders should consider investing money into professional development opportunities that will encourage teachers to learn and implement the shifts in the CCSSM with fidelity. Teachers should be provided various professional development opportunities such as collaborative learning through professional learning communities and job-embedded coaching (Hodkinson & Hodkinson 2005; Cobb & Jackson, 2011a).

Professional development should also be provided for principals, enabling them to develop an understanding of the Common Core standards and shifts so that they can support teachers in their professional learning. Principals who have a clear understanding of the shifts can then more accurately plan, coordinate and evaluate the curriculum and teaching and learning, and provide feedback and guidance to teachers that will support them as they develop an understanding of how to implement mathematical practices that

align with the CCSSM. Some teachers may be resistant to changing their instructional practices to align with the CCSSM, despite professional learning opportunities offered by the district. For this reason, principals should be encouraged to leverage the teacher evaluation system, and observe classroom teaching and learning on a frequent basis. When principals observe instructional practices that do not align with the district and school expectations, teachers should be provided with very specific feedback and expectations regarding mathematical practices that need to be incorporated into classroom instruction.

State Implications

In general, teachers reported feeling adequately to well-prepared to teach the CCSSM standards at their grade level. The mean responses range from 3.33 to 4.67 on a 5-point scale. On the other hand, teachers respond on average that they consistently or sometimes use the two mathematical practices that align with the CCSSM (means of 1.21 and 1.77), as well as the three mathematical practice that do not align with the CCSSM (means of 1.53, 2.10, and 2.43). These responses are based upon a 4-point scale, with a score of 1 indicating consistent use of the practice, and a score of 4 indicating never using the practice. This disconnect between feeling prepared to teach the CCSSM, yet still incorporating practices that do not align (i.e. use of mnemonics, teaching a wide range of topics, and showing students how to use discrete procedures and clues to solve math problems) has implications at the state level.

The CSDE may be interested in exploring the importance of establishing clear goals and expectations regarding CCSSM implementation. Rather than emphasizing student outcomes right away, the CSDE could establish clear expectations for districts

and schools to focus improvement goals on implementation of the Common Core with fidelity. For example, school and district improvement goals could focus on improving mathematical instruction through the use of a curriculum that focuses on key grade level standards, with an increased emphasis on developing procedural skill and fluency that facilitate problem solving at complex levels, and a diminished emphasis on teaching mnemonics and discrete procedures.

In addition, the CSDE could leverage the state evaluation system to drive changes related to teaching practices. The results of this research indicate that teachers who reported higher levels of principal involvement in planning, coordinating, and evaluating teaching and the curriculum also reported higher levels of using teaching practices that do not align with the CCSSM. If principals are expected to participate in professional development to develop their own effectiveness with the CCSSM, as well as to hone their skills as evaluators, then they will be better prepared to provide effective feedback regarding teachers' use of practices that are aligned to the CCSSM.

Based upon my research, teachers who reported higher levels of principal participation in teacher learning also reported higher levels of feeling prepared to teach the CCSSM. In order to leverage professional development to improve CCSSM implementation, the CSDE may consider ways it can provide guidance and opportunities for specific professional learning goals that align with the CCSSM. The CSDE may also be interested in examining the extent to which teachers and districts report using CSDE sponsored curricular and professional learning materials, and if necessary, what improvements can be made that teachers and principals learning the Common Core may find useful.

In addition, the CSDE may be interested in conducting further research about Common Core implementation in Connecticut school districts. For example, the CSDE may want to complete a similar study of school principals regarding their feelings of preparedness to lead the CCSSM, as well as their knowledge of the key shifts, to determine the need for further professional development opportunities. Additional research could also be conducted to distinguish between the needs of elementary versus middle school teachers. Furthermore, research could be conducted to distinguish between the varying professional development needs of urban, suburban, and rural schools.

Finally, as future reform efforts emerge at the state level, the CSDE may consider the statistically significant relationship between goal setting and professional learning to teachers' feelings of preparedness to teach the CCSSM. The CSDE could consider setting clear goals and expectations that initially prioritize professional development and fidelity of implementation over assessment outcomes. By setting clear goals and providing adequate professional learning experiences about future reform efforts, teachers may be more likely to feel prepared to implement the reform, and to implement the reform with fidelity.

Conclusions

This study shows statistically significant relationships between principal leadership behaviors, teachers' self-reported preparedness to teach the CCSSM, and the extent to which teachers reported using math practices that are aligned with Common Core expectations. Specifically, the extent to which teachers reported that their principal sets clear goals and expectations, or supports and participates in teacher learning, is

significantly related to the extent to which teachers reported feeling prepared to teach the CCSSM. Furthermore, teachers who reported higher levels of principals setting clear goals and expectations also reported lower levels of using math practices that are not aligned with the CCSSM. Although teachers who reported higher levels of principal planning, coordinating, and evaluating teaching and the curriculum reported higher levels of developing students' procedural skill and fluency, they also reported higher levels of using math practices that do not align with the key shifts in the CCSSM. Finally, teachers who reported higher levels of preparedness to teach the CCSSM also reported higher frequencies of using math practices that align with the key shifts in the CCSSM as well as math practices that do not align with the key shifts.

Importantly, the inclusion of control variables about teacher and school demographics did not change the key relationships in the models, thereby reducing concerns that omitted variables might drive the relationships of interest. By including the control variables in the regression analysis, additional statistically significant relationships became apparent. For example, teachers in urban schools reported lower levels of preparedness to teach the CCSSM than suburban teachers. In addition, teachers under the age of 35 reported lower levels of preparedness to teach the CCSSM than teachers over the age of 55. Male teachers reported lower levels than female teachers of using math practices that do not align with the CCSSM (i.e. teaching mnemonics and exposing students to a wide range of topics). Teachers aged 25-34 reported lower frequencies than teachers over age 55 of teaching mnemonics, a math practice that does not align with the CCSSM. Rural teachers reported higher frequencies than suburban teachers of dedicating class time to developing procedural skill and fluency, which is

aligned with the Common Core. On the other hand, urban and rural teachers also reported higher levels than their suburban counterparts of using mathematical practices that do not align with the key shifts in the CCSSM.

In summary, this study reveals important information regarding CCSSM implementation in the state of Connecticut, and has implications for CCSSM implementation across the country. There are also implications for reform implementation in general. Teachers may feel prepared to implement reform, but may not do so in a manner that aligns with policymakers' intentions. This research provides several suggestions for supporting teachers as they learn and implement new reform with fidelity. Most importantly, this research has implications for the importance of setting clear goals and expectations, as well as for providing professional development opportunities for learning new reform, and recognizing how it is different from previous initiatives. By setting clear goals and providing adequate professional learning experiences about future reform efforts, teachers may be more likely to feel prepared to implement new initiatives with fidelity.

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Appendix A

The Impact of Leadership Dimensions on Student Outcomes (Robinson, et al., 2008)

Leadership Dimension	*Meaning of Dimension*	*Effect Sizes (n) from studies (n)*	*Mean Effect Size*	*Std. Error*
Establishing goals and expectations	Includes the setting, communicating, and monitoring of learning goals, standards, and expectations, and the involvement of staff and others in the process so that there is clarity and consensus about goals.	49 effect sizes from 7 studies	0.42	0.07
Planning, coordinating, and evaluating teaching and the curriculum	Direct involvement in the support and evaluation of teaching through regular classroom visits and provision of formative and summative feedback to teachers. Direct oversight of curriculum through schoolwide coordination across classes and year levels and alignment to school goals.	80 effect sizes from 9 studies	0.42	0.06
Promoting and participating in teacher learning and development	Leadership that not only promotes but directly participates with teachers in formal or informal professional learning.	17 effect sizes from 6 studies	0.84	0.14

Appendix B

Information Sheet for Leadership Behaviors and Teachers' Preparedness for Implementing the CCSSM Survey

UCONN
UNIVERSITY OF CONNECTICUT

Principal Investigator: Morgaen Donaldson
Student: Angela Rossbach
Title of Study: The Relationship of Leadership Behaviors as Perceived by Teachers to Teachers' Self-reported Recognition and Preparedness for Implementing the Common Core State Standards in Mathematics

I am emailing you today to ask for your help. For my EdD program at UCONN, I am researching the ways that school principals can best support teachers as they implement the Connecticut Core Standards in Mathematics. You have been invited to participate because you are a K-8 Connecticut public school teacher who taught Mathematics during the 2014-2015 school year. The only thing you need to do is complete a short online survey by clicking on the link below. The entire survey should take between 5-10 minutes to complete.

Your responses are very important, and could lead to an increased understanding of the implementation of the Connecticut Common Core Standards in Mathematics. This understanding could lead to improved supports that will benefit teachers across the state of Connecticut.

Please click on the link below to go to the survey website (or copy and paste the survey link into your Internet browser).
Follow this link to the Survey:
Link
Or copy and paste the URL below into your internet browser:
URL address

Your participation will be confidential. You will not be paid for being in this study, although you will have the opportunity to enter a drawing for one of three $100 Amazon gift cards. This survey does not involve any risk to you. However, the benefits of your participation may impact society by helping increase knowledge about effective implementation of the Common Core State Standards.

You do not have to be in this study if you do not want to be. You do not have to answer any question that you do not want to answer for any reason. We will be happy to answer any questions you have about this study. If you have further questions about this project or if you have a research-related problem, you may contact me, Angela Rossbach (the doctoral student) at 860-868-2223 or my advisor, Morgaen Donaldson at 860-486-4438.

If you have any questions about your rights as a research participant you may contact the University of Connecticut Institutional Review Board (IRB) at 860-486-8802. The IRB is a group of people who review research studies to protect the rights and welfare of research participants.

Many thanks,
Angela Rossbach

Appendix C

CCSSM and Leadership Survey

PART I: This part of the survey is designed to gather information about your opinions and current level of preparedness for implementing the Connecticut Core Standards in Mathematics, also known as the Common Core Standards. Please answer these questions as honestly as you can, since the responses may help us to determine the supports that will be most helpful to teachers who are implementing the Connecticut Core Standards for Mathematics.

Did you teach Mathematics or another subject that is aligned with the Connecticut Core Standards for Mathematics in grades K-8 during the 2014-2015 school year?

- ◯ Yes
- ◯ No

How well do you think the 2007 PK-8 Mathematics Curriculum Standards are aligned with the new Connecticut Core Standards?

- ◯ Fully aligned
- ◯ Somewhat aligned
- ◯ Not at all aligned
- ◯ Not sure

How would you describe the support your school's leadership has provided to you as you transition your practice to align with the Connecticut Core Standards for Mathematics?

- ◯ Comprehensive—School leaders have provided me the tools, resources, and support I need to fully incorporate the expectations of the Connecticut Core Standards into my practice.
- ◯ Adequate—School leaders have provided me support to transition my practice to align with the Connecticut Core Standards, but more would be helpful.
- ◯ Minimal—I have received some information from school leaders about the transition to the Connecticut Core Standards, but little that would help me change my practice.
- ◯ Nonexistent—I received no information or support from school leaders about the transition to the Connecticut Core Standards.

How many times have you received feedback in the past year from a school administrator, mentor, coach, or another teacher about how to more fully incorporate the Connecticut Core State Standards for Mathematics into your practice?

- ◯ I did not receive any feedback.
- ◯ Once during the 2014-2015 school year
- ◯ 2-3 times during the 2014-2015 school year
- ◯ 4 or more times during the 2014-2015 school year

Have you participated in professional development/training on the Connecticut Core Standards for Mathematics?

- ◯ Yes

- ○ No

Who provided the training? Select ***all*** that apply.

- ☐ A staff member from my school
- ☐ A staff member from my district
- ☐ A professional development provider brought in by my district
- ☐ A professional development provider from our Regional Education Service Center (RESC)
- ☐ The State Department of Education (or its contractors)
- ☐ Other (please specify):
- ☐ I don't know.

Have you made any changes in your teaching practice in order to align it with the Connecticut Core Standards for Mathematics?

- ○ Yes
- ○ No

What changes in your teaching practices have you made in order to implement the Connecticut Core Standards for Mathematics? Select ***all*** that apply.

- ☐ Incorporating new curricular materials and instructional strategies in my teaching
- ☐ Asking students more questions and encouraging them to develop answers independently
- ☐ Structuring opportunities for students to develop and solve their own problems
- ☐ Increasing my use of national resources on teaching
- ☐ Diversifying the ways I assess student learning and provide feedback
- ☐ Increasing my collaboration with colleagues within my school and in other schools
- ☐ Other (please specify):

To what extent is your classroom instruction aligned with the Connecticut Core State Standards for Mathematics?

- ○ My classroom instruction is fully aligned with the Connecticut Core State Standards in Mathematics
- ○ My classroom instruction is somewhat aligned with the Connecticut Core State Standards in Mathematics
- ○ My classroom instruction is not aligned with the Connecticut Core State Standards in Mathematics
- ○ I don't know if my classroom instruction is aligned with the Connecticut Core State Standards in Mathematics

How often do you incorporate the following mathematical practices into your classroom instruction?

	Consistently	Sometimes	Rarely	Never	I don't know
Have students practice mnemonics to assist with remembering procedures.	○	○	○	○	○
Have students make connections between previous learning and new mathematical understandings.					

Dedicate class time to helping students develop procedural skill and fluency in core operations (such as multiplication tables)

Expose students to a wide range of math topics within each grade level in preparation for their future learning

Help students learn how to match discrete procedures with math problems and spend time teaching clues and practicing how to match them

Please select the grade that you primarily teach.

- Kindergarten
- Grade 1
- Grade 2
- Grade 3
- Grade 4
- Grade 5
- Grade 6
- Grade 7
- Grade 8
- Other

Please select the grade for which you feel the most prepared to implement the Connecticut Core Standards in Mathematics.

- Kindergarten
- Grade 1
- Grade 2
- Grade 3
- Grade 4
- Grade 5
- Grade 6
- Grade 7
- Grade 8
- none of the above

How prepared do you feel to teach each of these standards to Kindergarten students? Please mark a response for all ten standards.

	Very poorly prepared	Poorly prepared	Adequately prepared	Well prepared	Very well prepared
Count to 100 by ones and by tens.					

Represent a number of objects with a written numeral 0-20.

Count to answer "how many?" questions about as many as 20 things arranged in a line, a rectangular array, or a circle.

Identify whether the number of objects in one group is greater than, less than, or equal to the number of objects in another group, e.g. by using matching and counting strategies.

Solve addition and subtraction problems, and add and subtract within 10, e.g. by using objects or drawings to represent the problem.

Decompose numbers less than or equal to 10 into pairs in more than one way, e.g. by using objects or drawings.

For any number from 1 to 9, find the number that makes 10 when added to the given number, e.g., by using objects or drawings.

Describe measurable attributes of objects, such as length or weight.

Correctly name shapes regardless of their orientations or overall size.

Compose simple shapes to form larger shapes. For example, "Can you join these two triangles with full sides touching to make a rectangle?"

How prepared do you feel to teach each of these standards to First Grade students? Please mark a response for all ten standards.

	Very poorly prepared	Poorly prepared	Adequately prepared	Well prepared	Very well prepared
Compare two two-digit numbers based on meanings of the tens and ones digits.					
Add within 100, including adding a two-digit number and a multiple of 10, using concrete models or drawings.					
Use addition and subtraction within 20 to solve word problems, with unknowns in all positions.					
Understand subtraction as an unknown-addend problem.					
Apply properties of operations (commutative and associative) as a strategy to add and subtract.					
Describe the shares of partitioned circles and rectangles using the words: halves, fourths, and quarters.					
Given a two-digit number, mentally find 10 more or 10 less than the number without counting; explain the reasoning used.					
Tell and write time in hours and half-hours using analog and digital clocks.					

Distinguish between defining attributes (e.g., triangles are closed and three-sided) versus non-defining attributes (e.g., color, size, orientation).

Compose two- and three- dimensional shapes (triangles, squares, rectangles, trapezoids, half-circles; cubes, prisms, cones, cylinders) to create a composite shape.

How prepared do you feel to teach each of these standards to Second Grade students? Please mark a response for all ten standards.

	Very poorly prepared	Poorly prepared	Adequately prepared	Well prepared	Very well prepared
Represent whole number sums and differences within 100 on a number line diagram.					
Count within 1000; skip-count by 5s, 10s, and 100s.					
Add up to four two-digit numbers using strategies based on properties of operations; explain why strategies work.					
Understand that in adding or subtracting three-digit numbers, one adds or subtracts hundreds and hundreds, tens and tens, ones and ones.					
Determine whether a group of objects (up to 20) has an odd or even number of members, e.g., by pairing objects or counting them by 2s.					
Mentally add or subtract 10 or 100 to or from, respectively, a number between 100 and 900.					
Use addition and subtraction within 100 to solve word problems involving lengths that are given in the same units, e.g., by using drawings (such as drawings of rulers) and equations with a symbol for the unknown number to represent the problem.					
Generate measurement data by measuring lengths of several objects to the nearest whole unit, or by making repeated measurements of the same object.					
Solve word problems involving dollar bills, quarters, dimes, nickels, and pennies: use $ and ¢ symbols appropriately.					
Recognize and draw shapes with certain attributes, such as a given number of angles or equal faces.					

How prepared do you feel to teach each of these standards to Third Grade students? Please mark a response for all ten standards.

	Very poorly prepared	Poorly prepared	Adequately prepared	Well prepared	Very well prepared
Use the four operations to solve two-step word problems.					
Interpret products of whole numbers, e.g., interpret 5 × 7 as the total number of objects in 5 groups of 7 objects each.					

Represent a fraction 1/*b* on a number line diagram by defining the interval from 0 to 1 as the whole and partitioning it into *b* equal parts.

Understand that two fractions are equivalent if they are the same size, or represent the same point on the number line.

Recognize that a valid comparison relies on two fractions referring to the same whole.

Partition shapes into parts with equal areas. Express the area of each part as a unit fraction of the whole. *For example, partition a shape into 4 parts with equal area, and describe the area of each part as 1/4 of the area of the shape.*

Determine the unknown whole number in a multiplication or division equation relating three whole numbers. *For example, determine the unknown number that makes the equation true in each of the equations 8 × ? = 48, 5 = _ ÷ 3, 6 × 6 = ?*

Solve word problems involving addition and subtraction of time intervals in minutes, e.g., by representing the problem on a number line diagram.

Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l).

Solve real world and mathematical problems involving perimeters of polygons, including finding the perimeter given the side lengths, finding an unknown side length, and exhibiting rectangles with the same perimeter and different areas or with the same area and different perimeters.

How prepared do you feel to teach each of these standards to Fourth Grade students? Please mark a response for all ten standards.

	Very poorly prepared	Poorly prepared	Adequately prepared	Well prepared	Very well prepared
Find whole number quotients and remainders with up to four-digit dividends and one-digit divisors.					
Find all factor pairs for a whole number in the range between 1 and 100, and know that a whole number is a multiple of each of its factors.					
Solve word problems involving addition and subtraction of fractions with like denominators.					
Solve word problems involving multiplication of a fraction by a whole number.					
Use decimal notation for fractions with denominators of 10 or 100; compare two decimals to hundredths.					
Solve addition and subtraction problems to find unknown angles in a 2-D diagram.					
Apply area and perimeter formulas for rectangles to solve word problems.					
Recognize a line of symmetry for a 2-D figure.					

Represent problems using equations with a letter standing for the unknown quantity.

Make a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8).

How prepared do you feel to teach each of these standards to Fifth Grade students? Please mark a response for all ten standards.

	Very poorly prepared	Poorly prepared	Adequately prepared	Well prepared	Very well prepared
Find whole number quotients of whole numbers with up to four-digit dividends and two-digit divisors.					
Solve word problems involving addition and subtraction of fractions referring to the same whole, including cases with unlike denominators.					
Solve word problems involving multiplication of fractions and mixed numbers.					
Solve word problems involving division of unit fractions by non-zero whole numbers.					
Add, subtract, multiply, and divide decimals to hundredths.					
Convert among different sized measurement units within a given measurement system to solve multi-step, real world problems.					
Find the volume of a right rectangular prism with whole-number side lengths by packing it with unit cubes, and show that the volume is the same as would be found by multiplying the edge lengths.					
Given a relation, graph points on the coordinate plane to solve real-world and mathematical problems.					
Relate volume to the operations of multiplication and addition and solve real world and mathematical problems involving volume.					
Use benchmark fractions and number sense of fractions to estimate mentally and assess the reasonableness of answers.					

How prepared do you feel to teach each of these standards to Sixth Grade students? Please mark a response for all ten standards.

	Very poorly prepared	Poorly prepared	Adequately prepared	Well prepared	Very well prepared
Perform the four operations with multi-digit decimals using standard algorithms.					
Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order.					

Solve problems involving percentages: including finding the whole given a part and the percent.

Understand that positive and negative numbers are used together to describe quantities having opposite directions or values.

Solve problems using volume formulas, particularly of right rectangular prisms with fractional edge lengths.

Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate.

Solve unit rate problems including those involving unit pricing and constant speed.

Evaluate an equation, using substitution, to determine whether a give number makes an equation or inequality true.

Give quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation).

Write, interpret, and explain statements of order for rational numbers in real-world contexts.

How prepared do you feel to teach each of these standards to Seventh Grade students? Please mark a response for all ten standards.

	Very poorly prepared	Poorly prepared	Adequately prepared	Well prepared	Very well prepared
Solve problems involving scale drawings of geometric figures in the coordinate plane.					
Work with angles (supplementary, complementary, vertical, adjacent); find unknown measures.					
Draw geometric shapes with given conditions: triangles given three angle or three side measures.					
Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.					
Informally derive the relationship between the circumference and area of a circle.					
Use proportional relationships to solve multistep ratio problems.					
Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.					
Use variables to construct simple equations and inequalities to solve problems.					
Use data from a random sample to draw inferences about a population.					

Find probabilities of compound events using organized lists, tables, tree diagrams.

How prepared do you feel to teach each of these standards to Eighth Grade students? Please mark a response for all ten standards.

	Very poorly prepared	Poorly prepared	Adequately prepared	Well prepared	Very well prepared
Know that there are irrational numbers. Approximate them with rational numbers.					
Work with radicals and integer exponents.					
Perform operations with number expressed in scientific notation.					
Solve problems involving the volume of cylinders, cones, and spheres.					
Graph proportional relationships, interpreting the unit rate as the slope of the graph.					
Describe effect of transformations (dilations, reflections, rotations, translations) on 2-D figures in the coordinate plane.					
Solve linear equations with rational number coefficients.					
Solve systems of two linear equations in two variables algebraically or graphically.					
Sketch a graph that exhibits the qualitative features of a function that has been described verbally.					
Informally fit a straight line to a scatter plot that suggests a linear association.					

Leadership

PART II: This part of the survey is designed to provide a profile of principal leadership. It consists of 17 behavioral statements that describe principal job practices and behaviors. You are asked to consider each question in terms of your observations of the principal's leadership over the past school year.

Read each statement carefully. Then select the number that best fits the specific job behavior or practice of this principal during the past school year.
In some cases, these responses may seem awkward; use your judgment in selecting the most appropriate response to such questions. Please try to answer every question. Thank you.

To what extent does your principal ...?

	Almost Never	Seldom	Sometimes	Frequently	Almost Always
Develop a focused set of annual school-wide goals.					
Use data on student performance when developing the school's academic goals.					

Develop goals that are easily understood and used by teachers in the school.

Communicate the school's mission effectively to members of the school community.

To what extent does your principal ...?

	Almost Never	Seldom	Sometimes	Frequently	Almost Always
Refer to the school's academic goals when making curricular decisions with teachers.					
Ensure that the classroom priorities of teachers are consistent with the goals and direction of the school.					
Review student work products when evaluating classroom instruction.					
Make clear who is responsible for coordinating the curriculum across grade levels (e.g. the principal, assistant principal, or teacher-leaders).					

To what extent does your principal ...?

	Almost Never	Seldom	Sometimes	Frequently	Almost Always
Draw upon the results of school-wide testing when making curricular decisions.					
Participate actively in the review of curricular materials.					
Meet individually with teachers to discuss student progress.					
Use tests and other performance measures to assess progress toward school goals.					

To what extent does your principal ...?

	Almost Never	Seldom	Sometimes	Frequently	Almost Always
Ensure that inservice activities attended by staff are consistent with the school's goals.					
Actively support the use in the classroom of skills acquired during inservice training.					
Obtain the participation of the whole staff in important inservice activities.					
Lead or participate in teacher inservice activities concerned with instruction.					

Set aside time at faculty meetings for teachers to share ideas or information from inservice activities.

○ ○ ○ ○ ○

Demographics

Part III. You are almost finished! Please answer the following demographic questions, which will help me as I analyze the survey information. Please be assured that all responses are completely confidential, and no personally identifiable information will be shared with anyone at any time.

Please select the description that best describes your current role.

- ○ Classroom teacher
- ○ Teacher leader, including coach or specialist
- ○ Special Education teacher
- ○ Instructional Support teacher
- ○ Other

What teaching certification(s) do you currently hold?

- ☐ Durational Shortage Area Permit (DSAP)
- ☐ Initial Educator Certificate
- ☐ Provisional Educator Certificate
- ☐ Professional Educator Certificate
- ☐ Alternate Route to Certification (ARC)
- ☐ Teach for America (TFA)
- ☐ Other (please explain)

Years, at the end of this school year, that you have:

	<2 years	2-4 years	5-9 years	10-15 years	>15 years
been in your present position	○	○	○	○	○
been in your current school	○	○	○	○	○
worked for the current principal	○	○	○	○	○
worked as a teacher in the State of Connecticut	○	○	○	○	○

Which of the following best describes the location of your school?

- ○ Urban
- ○ Suburban
- ○ Rural

- Other

Approximately how many students are enrolled at your school?

- 100 or less
- 101-250
- 251-400
- 401-550
- 551 or more

Please indicate your age:

- < 25
- 25-34
- 35-44
- 45-54
- > 54

Please indicate your gender

- Male
- Female

Please indicate your race

- Caucasian
- Hispanic or Latino
- Black or African American
- Native American
- Asian/Pacific Islander
- Other

Appendix D

Dr. Philip Hallinger
7250 Golf Pointe Way
Sarasota, FL 34243
hallinger@gmail.com

February 12, 2015

Angela Rossbach

Dear Angela:

As copyright holder and publisher, you have my permission as publisher to use the *Principal Instructional Management Rating Scale* (*PIMRS*) in your research study. In using the scale, you may make unlimited copies of any of the three forms of the PIMRS.

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Sincerely,

Professor Philip Hallinger

Appendix E

Common Core Survey

LELAND COGAN <cogan@msu.edu> Fri, Mar 13, 2015 at 10:58 AM
To: Angela Rossbach <aross0508@gmail.com>
Cc: Bill Schmidt <bschmidt@msu.edu>

Angela,

I prepared a pdf of the questions we used in our national survey. Focus, coherence, and rigor are features of the Common Core but they are not necessarily well understood by teachers. Everyone has an idea of what these concepts mean and virtually all would say they are important for students' learning. However, beliefs and practice are frequently at odds. This may well be the case with these concepts as teachers seek to implement the CCSSM in their teaching as many do not have a clear understanding of how these are embodied and expressed in the CCSSM. Most get that 'focus' has to do with paring down the number of concepts/ideas teachers and students spend time on. However, the coherence most teachers talk about is simply the logical development of their material across the year. We refer to this as micro-coherence and it is important but the coherence embedded in the CCSSM is the macro-coherence developed as concepts build across the grades. Teachers begin to grasp the importance of this coherence as they have cross-grade level discussions and discover what teachers in other grades are doing. The CCSSM coherence is all about making students' mathematics learning across grades logical, with what was learned previously built upon and expanded subsequently and working toward deeper understanding.

This possible gap between beliefs and practice is one reason we focused on what teachers would report doing in their classrooms. One of the questions is grade-specific and includes CCSSM standards appropriate for the grade they teach as well as some standards from a grade below and a grade above. We focused on this item in our report. If you decide to include any of these questions in the survey you develop, please acknowledge the source as our work was NSF-funded.

Leland