

Moving Beyond Damned if You Do, Damned if You Don't: Readiness for Change

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Abstract

We know little about the supports principals need to lead change. This lack of knowledge is unfortunate, because principal leadership is understood to be critical for successful school reform. Using a randomized control trial, we tested whether the opportunity to participate in a year-long, content-focused professional development intervention would help principals feel prepared to provide instructional leadership for the transition to new standards. Results suggest professional development was impactful for principals' self-reported attitudes toward facilitating the implementation of new standards. Study findings offer support for use of professional development as a means of building principals' ability to lead change efforts.

Keywords: education reform, leadership, principals, professional development, randomized trial

Introduction

Policy mandates, especially when they are not coupled with adequate training and support for implementers, place leaders in a "damned if you do, damned if you don't" situation, whereby moving forward with implementation often results in failure to meet the policy aims, and failure to adopt the policy change can result in reprimand or even employee turnover (Drake, Auletto, & Cowen, 2019; Glazer, 2018). Still, educators are all too familiar with *waiting it out* as a tactical response to forced change; all schools and systems have their own graveyard of initiatives (Coburn, 2016). Using a randomized control trial, we set out to test whether a content-focused, year-long professional development intervention, with a special emphasis on collaborative efforts, might influence elementary school principals' readiness to lead implementation of new mathematics and science content standards in their schools. Specifically, we expected principals who participated in the professional development training to situate concerns around adopting new content standards farther along in the implementation cycle than principals in the comparison group.

In 2008, the Florida legislature required the State Board of Education to review the *Sunshine State Standards* and replace them with the *Next Generation Sunshine State Standards* (NGSSS). The State Board of Education adopted the revised standards for mathematics, reading and language arts in 2007 and for science in 2008. The revision of the standards was undertaken in an effort to improve student performance via more rigorous and effective instructional standards. The impetus for the revised standards arose, at least in part, from observed trends in student achievement on state- and national-level indicators: Florida Comprehensive Assessment Test (FCAT; Florida Department of Education, 2008), and National Assessment of Educational Progress (NAEP; National Center for Educational Statistics, 2007; U.S. Department of Education,

2006), respectively; with FCAT mathematics results indicating that students' performance declined through elementary school, followed by the lowest levels of proficiency at sixth grade (Florida Department of Education, 2008). Florida's legislature called for the revision of content standards partly due to the poor quality of the standards relative to other states (Peterson & Hess, 2007). One of the most important priorities for those states working to transition to new standards involves efforts aimed at building educators' understanding of why and how the standards are being implemented. With regard to the adoption of the Florida NGSSS, the revision of the standards created a need for principal leadership to support and manage the necessary changes in teacher practice to implement the new standards.

The policy mandate requiring adoption of new standards was intended, of course, to drive changes in teachers' classroom practice. Changes in teachers' instruction are not easily adopted, and teachers frequently resist implementation of new policies and procedures that directly impact their practice (O'Sullivan, 2002; Snyder, Bolin, & Zumwalt, 1992). Resistance – or lack of will – is not the only threat to successful change in practice; even when teachers hold positive perceptions of the policy changes designed to improve instruction, implementation may be hindered for reasons ranging from misinterpretation of the policy to a lack of skills, knowledge, or both, or a lack of capacity required for successful implementation (Bekalo & Welford, 2000; Beretta, 1990; Pulkkinen, Räikkönen, Pirttimaa, & Jahnukainen, 2019). However, principals may provide support for changes in classroom practices via facilitation of development of both teacher will and teacher capacity to change instruction (Demetriadis, Barbas, Moholides, Palaigeorgiou, Psillos, & Vlahavas, 2003).

The uptake of new, more rigorous standards in mathematics and science is thought to require strong instructional leadership practices from principals, in part because at the time of this policy change, most schools did not have coaches or specialists trained in mathematics and science leadership (Spillane, 2005; Supovitz, Sirinides, & May, 2010). Moreover, there is evidence that teachers benefit from strong principal instructional leadership in mathematics when working toward changes in mathematics instruction (Nelson & Sassi, 2005). However, it is understood that school principals have varying levels of content knowledge in mathematics and science, ranging from fairly limited to strong skills and understanding (Nelson, Benson, & Reed, 2009; Nelson, Reed, Johnson, & Benson, 2007). Research suggests that for administrators to help improve student academic achievement, strong pedagogical content knowledge, which incorporates not only knowledge of the subject matter being taught but also administrator beliefs about what constitutes effective teaching in a specific content area, is crucial (Stein & D'Amico, 2002; Stein & Nelson, 2003). Taken together, these findings suggest that although teachers may benefit from strong principal instructional leadership, especially in mathematics and science content areas, principals may need to develop their own knowledge in order to meet the needs of their faculty.

Principal knowledge, in itself, is thought to be insufficient for assuring their support for the uptake and implementation of educational initiatives, with principal attitude toward change being an important consideration (Bose, Neumann, Becker, Maaz, & Baumert, 2019; Goddard, Hoy, & Hoy, 2000). Changes that are meaningful and impactful are foundational in nature, rather than merely superficial, and require not only the acquisition of new knowledge for administrators and teachers, but also changes in educators' beliefs and attitudes about teaching, learning, and leading (Sparks, 2002). Studies indicate that principals' understanding of, and beliefs about, mathematics instruction influences how well they are able to identify high quality mathematics teaching and strategies for supporting that instruction (Nelson, 1998; Nelson, 2010; Spillane, Halverson, & Diamond, 2004). Moreover, evidence suggests that principals' improved knowledge of both content and pedagogy may be achieved through professional development opportunities (Leithwood, Louis, Anderson, & Wahlstrom, 2004).

Study Purpose

Although learning through professional development opportunities, content knowledge, and pedagogical knowledge have been shown to be potentially important factors related to the exercise of instructional leadership, experimental research exploring attitudes toward a reform come primarily from business management literature, with relatively few studies targeting school leaders. The evidence base around professional development impacts for school leaders is also thin, with most studies allowing causal claims emanating from the literature on teacher professional development. This study works to fill these gaps by exploring professional development impacts on principals' attitudes toward leading change efforts in their schools. Thus, the primary purpose of this experimental study is to contribute to the evidence base on principal professional development.

This study is part of a larger project (Leadership for Mathematics and Science Instruction [LMSI]) aimed at professional development of Florida elementary school principals with the distal goal of improved student outcomes in mathematics and science (Lang et al., 2010). The overarching goal of the LMSI professional development was facilitation of the implementation of the NGSSS. The primary objectives associated with this goal were improved principal content knowledge, pedagogical content knowledge, and understanding of the NGSSS. These new standards were understood to require administrator support for changes in teachers' instructional practices. Accordingly, additional objectives of the LMSI PD were to strengthen principals' ability to observe teacher's instruction and provide feedback and develop principals' ability to support communities of instructional practice in their schools.

The primary outcome of interest in this study was principals' readiness to lead the adoption and implementation of the NGSSS in their schools. As operationalized, principals' readiness to lead implementation included principals': attitudes toward, knowledge of, and support for the new standards; knowledge of resources that may be needed to facilitate implementation; and knowledge of how changes in teacher practice might be supported and encouraged. According to the LMSI theory of change, content-focused professional development aimed at developing principals' will and capacity to lead the adoption and implementation of the NGSSS in their schools would result in improved teacher practice, and ultimately, student outcomes. The data and analyses reported in this manuscript focus on testing a subset of the hypothesized links presented in the logic model (Figure 1).

CONTEXT	INPUTS	ACTIVITIES	OUTPUTS	OUTCOMES
<p>State Board of Education replaces <i>SSS</i> with <i>NGSSS</i>.</p> <p>Statewide MSP (Florida PROMiSE) aims to prepare educators to make changes in instruction required to fulfill aims of mandated change in standards.</p> <p>Florida State University directs the principal training -- Leadership for Mathematics and Science Instruction (LMSI) project.</p> <p>LMSI PD designed to build will and capacity for implementation <i>NGSSS</i>.</p> <p>Principals invited to receive LMSI PD.</p>	<p>Elementary principals register to receive year-long LMSI PD.</p> <p>Expert facilitators to lead LMSI PD for principals.</p> <p>LMSI PD training materials for:</p> <ul style="list-style-type: none"> • <i>NGSSS in Math and Science</i> • <i>Mathematics and Science content knowledge</i> • <i>Mathematics and Science instructional activities</i> • <i>Communities of Instructional Practice</i> <p>Resources allocated for study of LMSI PD impacts. Receipt of LMSI PD is not contingent on participation in study.</p>	<p>4 face-to-face LMSI PD two-day sessions with lessons and activities on math and science depth of knowledge, classroom observations (videos), classroom observation protocol to guide standards based classroom observations, algebraic thinking, communities of instructional practice, lesson study</p> <p>Between session activities include having principals teach a model lesson in their schools, explore the standards database (e.g., scavenger hunt), reading journal articles and books related to improving instruction and observations.</p>	<p>Better understanding of the level of instruction called for by the <i>NGSSS</i>.</p> <p>Gain confidence in their classroom observation skills via the observation of videos.</p> <p>Gain content knowledge in mathematics and science.</p> <p>Gain understanding of <i>NGSSS</i> and instructional changes designed to support implementation.</p> <p>Facilitate Communities of Instructional Practice that prioritize focus on instructional changes related to <i>NGSSS</i>.</p> <p>Design strategies to support changes in teacher practice.</p>	<p>Principals' self-report readiness to lead implementation via:</p> <ul style="list-style-type: none"> • Improved understanding of the <i>NGSSS</i>, and how these differ from <i>SSS</i>. • Support implementation of <i>NGSSS</i> as an important goal for their faculty. • Improved confidence in their ability to meet the demands of leading this change initiative.

Figure 1. Logic Model for LMSI Study. Note. *SSS* = Sunshine State Standards. *NGSSS* = Next Generation Sunshine State Standards. MSP = Math & Science Partnership. PROMiSE = Partnership to Rejuvenate & Optimize Mathematics and Science Education. LMSI = Leadership for Mathematics and Science Instruction. PD = Professional Development.

Methods

This study employed a randomized control trial (RCT) as the primary method of investigation. In an effort to better understand the results of the RCT, we collected qualitative feedback from PD participants' on their anticipated use of knowledge and skills learned during the LMSI PD. A full analysis of the qualitative data is currently under review (LaVenia, 2015). Findings from the larger LMSI study are available (Lang et al., 2010; LaVenia, Lang, Schoen, & Moss, 2010) which report on outcomes associated with principals' knowledge of communities of instructional practice (CIPs), as well as mathematics content knowledge.

Participants and Setting

Principals were recruited for the LMSI study through a two-step process: First, principals were invited to register to receive the LMSI PD; second, registered principals (other than the first 50, explained below) were randomly assigned to receive the PD either in 2009 or 2010 and recruited to participate in the LMSI study. Participation in the study included completion of a battery of pre- and post-measures administered January and December 2009, respectively. Eligibility to receive the PD was not contingent on the principals' consent to participate in the study. When recruitment began spring 2008, there were $n = 2,266$ elementary and combination elementary/secondary school principals in 74 Florida school districts. The first $n = 50$ principals to register were enlisted in a pilot cohort, with PD that commenced in May 2008 and concluded in June 2009. The pilot study was used to understand how best to deliver professional development to principals statewide, and which components of the professional development program were most promising. The next $n = 350$ principals to register were randomly assigned in August 2008 to either the LMSI 2009 group or the waitlist control group. PD for the LMSI 2009 group spanned January through December of 2009. The waitlist control group received the LMSI PD the following year, spanning April through September of 2010.

Setting. LMSI PD was delivered in various locations across the state to cohorts as assigned by the randomization procedure. Allowances were made, as necessary (due to schedule conflicts), for principals to convene with different cohorts than assigned; however, all accommodations were made among cohorts of the same condition. For those principals assigned to the comparison condition, pre- and posttest administration was conducted on site, face-to-face, at various locations around the state.

Research question. Formally, this study was designed to answer the following research question: Did opportunity for participation, or assignment to treatment, in LMSI professional development impact principals' attitudes toward leading the implementation of Florida's NGSSS?

Intervention

To develop principal capacity to support teachers in the adoption and implementation of new standards, principals were offered four two-day (i.e., 4*16 hours) of face-to-face learning opportunities spaced over the course of one calendar year. In addition, we asked principals to complete follow-up activities between sessions on their own time. Together, these professional development activities aimed to improve elementary school principals' (a) mathematics content knowledge; (b) science content knowledge and skill in applying mathematics in the context of science; (c) knowledge of the new standards and benchmarks; (d) expertise in observing instruction and providing feedback; and (e) knowledge and skills needed to implement and sustain communities of instructional practice (CIP) focused on mathematics and science teaching and learning. Principals spent approximately 20% of their time working on each of the five aforementioned learning goals during the face-to-face professional development sessions. The applied, follow-up activities included: teaching a mathematics lesson in their school, exploring the standards database via a "scavenger hunt," work on CIP planning, and reading materials on

mathematics and science teaching and learning. The LMSI professional development was designed to impact principals' readiness to lead the adoption and implementation of the new math and science standards via building not only principals' will to lead implementation (i.e., support for the new standards, prioritization of resources, and facilitation of teacher change in practice) but also their capacity to lead implementation (i.e., improved content knowledge, knowledge of the standards, expertise in observation and feedback for teachers, and knowledge of communities of instructional practice).

The LMSI PD utilized an intensive approach to professional development to build principals' capacity to encourage teacher collaboration in CIPs as they worked toward adoption of reform oriented instruction. Principals *learned by doing* or engaged in activities that related to their daily work in order to maximize their success in applying new knowledge as they provided leadership and support in the implementation of the new standards at their respective schools. Further, the LMSI professional development was designed to align with what is known about effective dosage levels for professional development. Without evidence on this topic as it relates to principals, we relied on the available evidence on teacher professional development, and generalized to principals as instructional leaders. Specifically, a meta-analysis conducted by Scher and O'Reilly (2009) reported that the optimal duration (i.e., intensity, dosage, or span) for measurable changes in teachers' performance and student achievement in mathematics and science was one year to two years. A positive relation between hours spent in professional development activities and reform-oriented changes in teachers' instructional practices have been demonstrated for both mathematics and science content areas (Banilower, Boyd, Pasley & Weiss, 2003). The LMSI PD was delivered by two members of the research team; one with expertise in mathematics education and one with expertise in science. The content (face-to-face and homework), agenda, and materials were the same for each cohort.

Comparison Condition

Most principals in the comparison group did not expect to participate in any professional development related to improved mathematics and science instruction. Of those that did, the professional development was expected to be short in duration and limited in scope. This description of the comparison group represents the findings from an online survey, conducted by the Florida Center for Research in Science, Technology, Engineering, and Mathematics (FCR-STEM) in June 2009 with a sample of elementary principals from throughout the state who were part of the comparison group.

Measures

Two measures were used in these analyses: one for capturing principals' self-reported readiness to lead the adoption of new standards, and one questionnaire for reporting demographics as well as principals' plans for applying knowledge from the LMSI professional development.

Dependent variable: Principal attitudes toward implementation of the new standards. The Change Facilitators Stages of Concern Questionnaire (CFSocQ; Hall, Newlove, George, Rutherford & Hord, 1991) was used to measure principals' concerns about change as the new content standards are implemented at their respective schools. We modified the question stems, with the authors' permission, to specify *the NGSSS standards* as "the innovation" being referenced. Respondents rated 35 items on a 0 to 6 point Likert scale rating how each item described their concerns at that point in time. The CFSocQ is based on the Concerns Based Adoption Model (CBAM; Hall, George, & Rutherford, 1979) developed to measure the level of adoption of educational practices and programs. The CFSocQ has been used in experimental research focused on professional development outcomes (LaVenia, 2015). The CFSocQ has satisfactory psychometric properties, with the developers reporting alpha coefficients ranging from .64 to .83 and test/retest reliabilities ranging from .65 to .86 (Hall et al., 1991).

The CFSocQ items measure respondents' current attitudes, feelings, and concerns about leadership of an innovation, or change. There are five items each for seven stages of concern. The instrument developers describe concern as "the composite representation of the feelings, preoccupation, thought, and consideration given to an issue or task" (Hall, George, & Rutherford, 1979, p.5). The seven stages are classified into one of three domains: self, task, and impact. Although the stages may appear to be developmental and predictably progressive, the developers of the CFSocQ caution that a linear trajectory of "stage development" is not to be expected for all successful change initiatives. The items representing the last stage, Refocusing, provide some clarity on the question of stage progression. Specifically, if successful implementation is the goal, then high percentages of respondents reporting stage six (Refocusing) as their highest stage of concern might be worrisome given that this stage represents participants who may not prioritize the innovation being investigated (i.e., NGSSS implementation activities). These respondents may be considering alternative approaches to support teaching and learning; they may be more concerned with another change initiative altogether.

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

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

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

Reliability estimates for this sample at both pre- and posttest are presented in Table 1. Both linear and nonlinear reliability estimates were calculated, due to the fact that the CFSocQ employs a Likert-type item response format and the responses arising from this format type may not be continuous. To supplement the linear reliability estimates, ordinal alphas (Zumbo et al., 2007) were calculated for both pre- and posttest data with the current sample.¹ The instrument manual for the CFSocQ provides conversion tables for converting raw scores to percentiles. In keeping with the suggested approach when conducting statistical analyses with these data, raw scores, instead of percentile scores, were used (George, Hall, & Stiegelbauer, 2006).

Table 1. *Reliability Coefficients for CFSocQ Stages of Concern at Pre- and Posttest With Analytic Sample*

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

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

Independent variable. Assignment to condition (participation in LMSI professional development vs. wait-list control conditions).

Covariates: LMSI general survey. The LMSI general survey was developed by the LMSI research team, and used to gather both demographic information and participant feedback on their understanding and exposure to the NGSSS (e.g., any other professional development opportunities related to the NGSSS). In the general survey, we asked PD participants to share their plans for applying what they learned during the LMSI PD sessions via the following open-ended questions:

1. Please describe 1–3 most significant things you learned during the LMSI PD.
2. How will you use what you learned in your school setting? For example, what will you do more of, less of, differently, etc.?

Data Analysis

Descriptive statistics were calculated for participant demographics as well as frequencies for both pre- and posttest for each of the CFSocQ stages of concern. Additionally, multivariate analysis of covariance (MANCOVA) was used to test the impact of assignment to the LMSI professional development on principals’ highest stage of concern, controlling for pretest CFSocQ highest stage. Although other covariates were available (e.g., gender, years of experience, areas of

¹ For instruments where the number of response categories is high, the estimates for linear alpha and Cronbach’s alpha tend to be very similar.

certification) these covariates did not improve model fit, and so were eliminated from final analyses. Further univariate analyses were run to investigate the impact of treatment on each of the individual stages of concern. The MANCOVA was followed up with discriminant analysis in order to investigate how the dependent variable (i.e., posttest highest CFSoc stage of concern) discriminates the two groups (i.e., intervention and comparison).

Results

Analytic Sample

The analytic sample for this work included those elementary school principals from across Florida who registered to participate in the LMSI professional development and consented to participate in the LMSI investigation of professional development impacts. Participation in the LMSI study was not a requirement for receipt of professional development. The analytic sample for each research question is the same, and includes only those principals who (a) consented to participate in research, (b) completed both pre- and posttests, and (c) did not change schools during SY 2008-09 and SY 2009-10. The decision to restrict the analytic sample to those principals who remained in their schools during the study period was made because the research team believes the CFSocQ to be a context-specific measure (i.e., principals concerns are shaped in part by their particular school and faculty needs). Since our goal was to investigate changes in concern associated with treatment condition, we felt this analytic sample best suited to the research questions. Please see Figure 2 for more detail on participant flow. The final analytic sample includes 110 elementary principals, with $n = 63$ assigned to the professional development (or treatment, hereafter Tx) condition, and $n = 47$ in the business-as-usual waitlist comparison group. All analyses presented were conducted using SPSS version 25. A full report on how we arrived at the analytic sample for this study, a participant flowchart, as well as detailed analyses of attrition for the study, are presented in Figure 2. Previously reported findings using multinomial logistic regression as the analytic strategy indicate that increased attendance ($M = 34.89$, $SD = 30.73$; Table 3) in LMSI PD was associated with statistically significant increased likelihood of principals' concerns being focused on management, consequences, or collaboration (LaVenía, 2015).

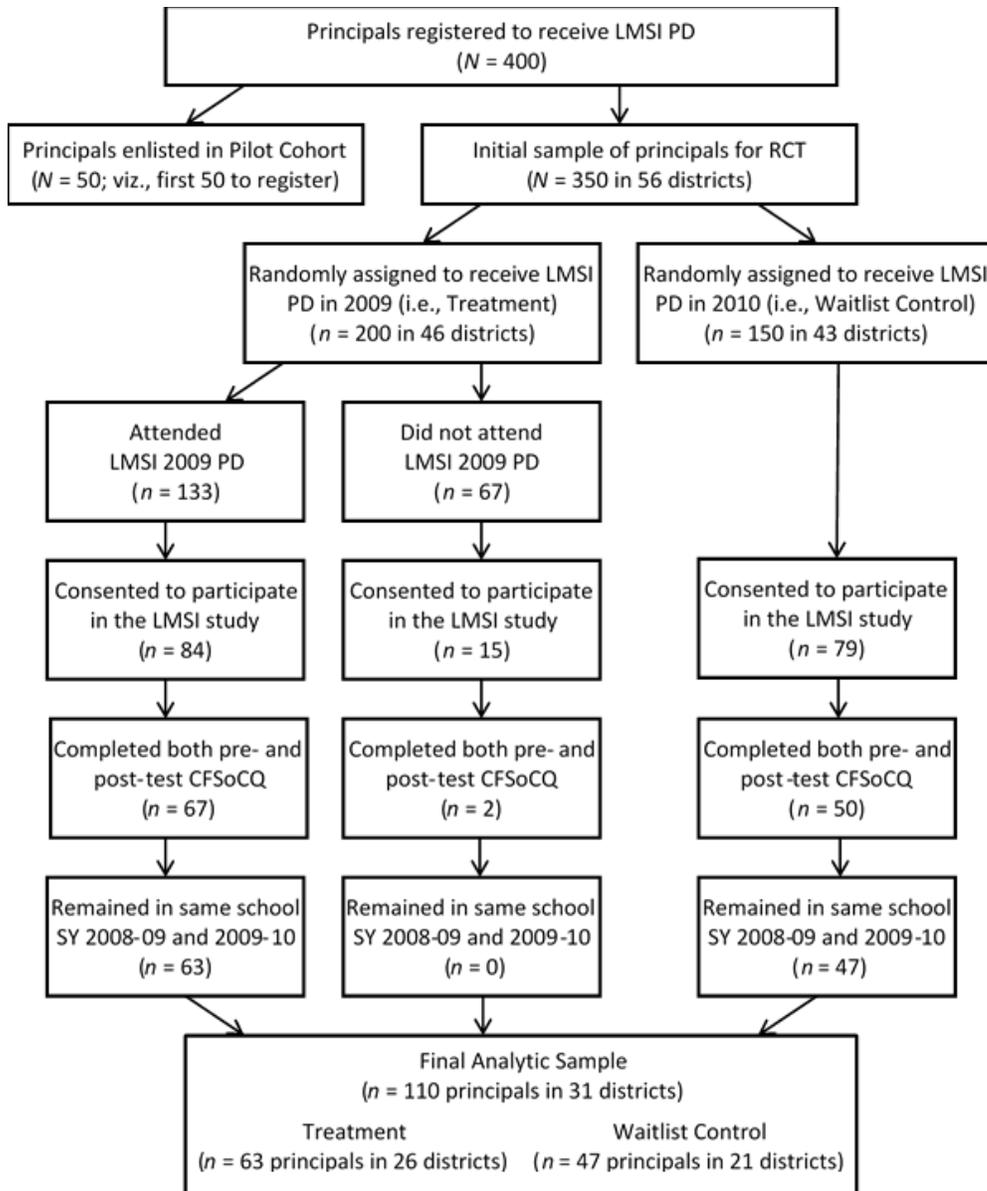


Figure 2. Participant flow chart illustrating the reduction of sample size from the initial sample of registered principals to the final analytic sample, based on the sequential filtering by whether the principal consented to participate in the study, completed both pre- and post-measures, and remained in the same school during SY 2008–09 and 2009–10. LMSI = Leadership for Mathematics and Science Instruction. PD = Professional Development. RCT = Randomized Controlled Trial. CFSocQ = Change Facilitator Stage of Concern Questionnaire. SY = School Year.

Descriptive Statistics

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

Frequencies for dependent variable. Table 2 shows that at pretest stages 0 (Awareness), 2 (Personal), and 6 (Refocusing) are not indicated as principals’ highest stage of concern, with either zero (stages 0 and 6) or only one (stage 2) principal indicating this as the highest stage of

concern. The majority of principals in both groups endorsed stage 1 (Informational) as their highest stage of concern at pretest. Analysis of posttest highest CFSocQ (Table 2) show the majority of treatment group principals indicate stage 5 (Collaboration) as their highest stage of concern, while comparison group principals indicate stage 1 (Informational) as their highest stage.

Table 2. Frequency Statistics for Pre- and Posttest CFSocQ Highest Stage of Concern

	Pretest				Posttest			
	Treatment		Control		Treatment		Control	
CFSocQ highest stage	<i>N</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Stage 0 Awareness	0	0.0	0	0.0	3	4.8	0	0.0
Stage 1 Informational	39	61.9	26	55.3	6	9.5	17	36.2
Stage 2 Personal	0	0.0	1	2.1	0	0.0	0	0.0
Stage 3 Management	6	9.5	4	8.5	6	9.5	5	10.6
Stage 4 Consequence	8	12.7	5	10.6	15	23.8	10	21.3
Stage 5 Collaboration	10	15.9	11	23.4	33	52.4	15	31.9
Stage 6 Refocusing	0	0.0	0	0.0	0	0.0	0	0.0
Total	63	100.0	47	100.0	63	100.0	47	100.0

Note. CFSocQ = Change Facilitators Stages of Concern Questionnaire

Frequencies and descriptives for principal characteristics variables. As shown in Table 3, the sample was predominantly female (84.5%) certified elementary education teachers (70.9%), with Master’s degree as the highest degree earned (66.4%). Principals in this sample have an average of twelve years teaching experience ($M = 12.01$, $SD = 6.29$, range = 0 to 35) and nearly three and one half years of experience as a school principal ($M = 3.43$, $SD 1.57$, range = 1 to 10).

Table 3. *Descriptive Statistics for Principal Characteristic Variables for Treatment, Comparison, and Full Sample*

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

Note: PD = professional development.

Demographic similarity of the two groups was tested for categorical indicators using chi-square tests of independence (with Yates Continuity Correction); results indicated no significant association between condition and gender, $\chi^2(1, n = 110) = .44, p = .51, phi = .09$; no significant association between condition and elementary educator certification, $\chi^2(1, n = 110) = 1.81, p = .18, phi = -.15$; no significant association between condition and educator certification $\chi^2(1, n = 110) = .00, p = .99, phi = .03$; and no significant association between condition and highest degree earned $\chi^2(2, n = 110) = 2.06, p = .36, phi = .14$. Independent samples t-tests were conducted to compare groups on continuous principal characteristics variables indicating years as elementary principal, total years as principal, years elementary teacher, years as STEM teacher, and total years teaching; no significant differences in scores for treatment versus comparison principals were found for any of the characteristics variables.

Results of MANCOVA and Discriminant Analysis

Formally, this study was designed to answer the question: Did opportunity for participation, or assignment to treatment, in LMSI professional development impact principals' self-reported readiness for leading the implementation of Florida's NGSSS? Assumptions underlying MANCOVA were tested and found to be tenable. Using Pillai's trace, there was a significant effect of LMSI PD on principals' self-reported stage of concern, $V = 0.32$, $F(7, 104) = 7.04$, $p = .000$. However, separate univariate ANOVAs on the outcome variables revealed non-significant treatment effects on stage 0 $F(1, 117) = 0.07$, $p = .793$, stage 2 $F(1, 117) = 2.46$, $p = .120$, stage 3 $F(1, 117) = 0.00$, $p = .996$, stage 4 $F(1, 117) = 2.69$, $p = .104$, stage 5 $F(1, 117) = .946$, $p = .333$, and stage 6 $F(1, 117) = 1.25$, $p = .266$, and significant treatment effects on stage 1 $F(1, 117) = 38.85$, $p = .000$. The MANCOVA was followed with discriminant analysis, which revealed a single discriminant function, canonical $R^2 = .53$. This discriminant function significantly differentiated the treatment and comparison groups, $\Lambda = 0.72$, $\chi^2(7) = 34.27$, $p = .000$. These results provide support for the LMSI PD as a means for improving principals' perception of their readiness to lead their schools in adopting Florida's NGSSS. In particular, given that participants in both groups were overwhelmingly concerned with gathering information, or becoming knowledgeable about the new standards, at baseline, the observation of treatment effects on stage 1 (Information) is not surprising.

Qualitative Feedback on Principals' Plans for Applying PD Content

All principals in the treatment condition ($n = 63$) provided qualitative feedback on the PD. In order to better understand whether and how the LMSI PD was useful for participants, we asked principals the following open-ended questions:

1. Please describe 1-3 most significant things you learned during the LMSI PD.
2. How will you use what you learned in your school setting?
 - a. What will you do more of, less of, differently, etc.?

The first author and a graduate student worked to analyze the qualitative responses. Participants' written responses were entered into Microsoft Word. First, we reviewed the written responses independently, using open coding. We then came together multiple times over the course of several weeks to discuss our findings, effectively interviewing and re-interviewing one another to outline and examine our individual and collective understanding of the data. During these meetings, we worked to refine our codes and obtain interrater reliability of 0.80 (Miles & Huberman, 1994). Our analyses revealed several themes. First, principals wrote about the importance of *applied learning* activities, *focus on understanding* how students arrive at their answers, *creating safe spaces* for students to struggle to arrive at understanding, and the *importance of collaboration* between teachers. Table 4 offers a summary of responses aligned with each of the codes identified.

Table 4. *Coding for Open-ended Questions*

Code	General statement	Specific statement	Total (/63)
<i>applied learning activities</i>	47	38	85
<i>focus on understanding</i>	52	44	96
<i>creating safe spaces for students</i>	35	19	54
<i>importance of collaboration</i>	26	39	65

The following qualitative comments (pseudonyms are used) collected from the LMSI General Survey illustrate the types of changes principals in the LMSI PD condition planned to make in their school sites:

Christy: *“I will try to instill in teachers and students that **it’s ok to take risk** when we are trying to learn Science and Math.”* [creating safe spaces]

Alexis: *“**More hands on!** We are going to pool our Math/Science resources into a resource room. And I have to promote the idea of how to differentiate between observations and inferences, ex: having students decide for themselves via investigation.”* [applied learning activities]

John: *“I will bring back the information and share it at our school-wide Math/Science PLC meetings. I will do more listening and **evaluating my student’s explanations** rather than focusing on their answers (right/wrong).”* [focus on understanding; importance of collaboration]

Jenn: *“I learned how to build the capacity for building **collaborative relationships** at our school. We learned how children learn to think mathematically. Specifically, we are implementing several of the activities we learned in this PD. Our school is doing a school-wide book study called *“What if our ABCs Were Our 123s.”* This book has provided us with an **avenue to have discussions** about Mathematics and learning.”*

Carol: *“My eyes are opened to how important **learning communities** are and can be / I also am reminded how we learn by doing and kids do, too. We need to do more experiments and hands on activities.”* [importance of collaboration]

Discussion

This study was undertaken because we have too few studies of principal professional development that are designed to allow for causal claim; much of what we use for informing our professional development for school leaders is based on evidence of professional development for business leaders and/or teachers. Thus, the primary aim of this study was to test whether assignment to attend the LMSI professional development impacted elementary principals’ self-reported attitudes toward leading implementation of new, more rigorous, content standards for the state: Florida’s Next Generation Sunshine State Standards (NGSSS) in Mathematics and Science. Findings suggest the LMSI training operated as expected, with principals in the professional development group reporting more advanced concerns around implementation of new standards. At baseline, both groups indicated that their primary concern in leading implementation of these new standards centered on a need for more information (e.g., how are the new standards different, what changes in instruction might be required, what supports would teachers need). This suggests that principals entered the LMSI study with concerns that might be described as general and early in the policy implementation cycle; this might be thought of as agenda setting or issue identification.

Analyses presented here suggest that assignment to the professional development condition operated in the way the LMSI theory of change posited, with principals assigned to professional development reporting a significant change in their initial status of a primary focus on needing more information about the basic aims, requirements, and structure of the NGSSS to concerns related to management, consequences, and collaboration around the NGSSS. Results from support content-focused, job-embedded professional development for improving school leaders' self-reported readiness for change. Because LMSI PD was designed to improve: (a) mathematics and science content knowledge; (b) knowledge of the mathematics and science NGSSS and how these differ from prior standards; (c) improved understanding of the level of instruction called for by the NGSSS; and (d) strategies for supporting changes in teachers' practice, we would expect to see principals less concerned about basic knowledge related to the mathematics and science NGSSS as a result of the professional development opportunity. The shift to a focus on management, consequence, or collaboration concerns indicates that principals assigned to the professional development condition transitioned to concerns that are farther along in the implementation cycle (e.g., decision-making and implementation foci). These findings indicate that the intervention was successful at provoking an interest in finding solutions to potential roadblocks and developing principals' will to lead their schools in implementing the NGSSS. In particular, principals' qualitative feedback on their readiness to support collaboration among teachers, encourage risk taking and applied learning activities, as well as increased focus on students' thinking are particularly encouraging. Importantly, these findings also suggest that principals who did not have access to LMSI training were not provided with resources elsewhere (e.g., district or state training opportunities) to move them out of the information-seeking stage of implementation concerns.

Limitations

Given that (a) principals were randomly assigned to condition, and (b) the two groups were equivalent on the outcome of interest at baseline study provides an adequate test of the effects of assignment to attend LMSI PD on elementary principals' self-reported readiness to lead implementation of NGSSS in their schools. With regard to potential concerns around testing effects, it is worth noting that the CFSocQ is designed to capture participants' concerns at a particular time and the items do not have any "right" answers. Given that both comparison and treatment group participants completed the CFSocQ in the same manner (face-to-face) at the same time (baseline and end of PD), any testing effects would be shared between groups and should not be associated with the findings.

In randomized field trials, participant mobility and treatment crossover are always a concern. LMSI PD was delivered in locations across the state to cohorts as assigned by the randomization procedure. Allowances were made, as necessary (due to schedule conflicts), for principals to convene with different cohorts than assigned; however, all accommodations were made among cohorts of the same condition. In the LMSI project, no principals assigned to the waitlist control condition attended any of the 2009 PD sessions. However, 67 (33.5%) of the principals assigned to the treatment condition did not attend any 2009 PD sessions. Of the 133 principals who attended at least one 2009 PD session 84 (63.2%) consented to participate in the study and completed some if not all measures, and nine (6.7%) withdrew from the study and stopped attending PD sessions midway through 2009 (one of the nine changed to a high school in SY 2009-10, two of the nine left the principalship SY 2010-11). Otherwise, attendance among the remaining 124 LMSI 2009 PD attendees was high. Absences occurred minimally, with the mean contact hours ($M = 58$) for all 133 PD attendees equivalent to three and a half of the four 2-day sessions.

It is important to distinguish between principals' self-reported readiness to lead implementation of the NGSSS and successful leadership of the transition to the new standards. The limitations of

self-report questionnaires (Nisbett & Wilson, 1977) notwithstanding, there is evidence to support people's ability to accurately report on their attitudes and beliefs (Brown, 1999; Ericsson & Simon, 1984). Because the CFSocQ is a self-report of readiness to facilitate change, this study does not shed light on what principals actually did to support implementation of the NGSSS in their schools. Thus, additional research incorporating direct measures of principals' leadership for leading adoption of new standards is warranted.

One notable limitation in this study is that 67 of the principals assigned to the LMSI PD did not attend. There were various reasons for this (e.g., principals left the position or transferred districts). Our analytic sample is constrained to those principals who consented to participate and completed both pre- and post-test. Thus, we were not able to conduct analyses to reflect intent-to-treat for this study. Because randomized control trials are much needed in educational research, and for studies involving principals in particular, research teams working to conduct these studies with school leaders are faced with heightened challenges around principal mobility and the fact that principals' schedules are over-full (Sebastian, Camburn, & Spillane, 2018) and do not allow for much additional work (e.g., participation in professional development).

Implications

Regarding the results of this study in the context of the LMSI theory of change, it appears as though principals assigned to attend the LMSI professional development likely perceived themselves as more ready to lead the implementation of the NGSSS in their schools, based on the shifts in highest stage of concern demonstrated at posttest. The analytic sample in this study represents 31 of Florida's 67 districts, providing evidence from a range of Florida's elementary principals. Of the districts represented in this sample, nearly half are high-need districts, and there are urban, suburban, and rural districts retained in the analytic sample. In practical terms, results of this study offer compelling evidence for principal professional development programs as a means of impacting elementary grades principals' attitudes toward leadership for reform efforts. Findings show that assignment to professional development did improve principals' perceptions of their readiness to lead their schools in transitioning to the NGSSS. To the extent that principal attitude toward implementation is influential for actual implementation, investment in principal professional development is warranted. These results highlight the importance of professional development and resources for principals tasked with leading new initiatives in their school sites. In particular, the finding that principals in the comparison group maintained their focus on information-seeking over the course of one year is useful and suggests that without LMSI PD, principals were lacking opportunities for learning about how to support teachers' changes in practice. We hope this evidence will be used to inform decisions around professional development for school leaders, with emphasis on the opportunity for principals to engage in relevant, ongoing, content-focused professional learning.

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Dedication

This manuscript is dedicated to Dr. Laura B. Lang who passed away on May 7, 2019. Laura's career was spent in Florida as a special education teacher, outstanding secondary school principal, and as the Director of Florida State University's Learning Systems Institute. Throughout her career, Laura worked to improve teaching and learning within the state of Florida. She was passionate about the need for high-quality evidence in education, and passed this conviction along to her doctoral students. Being Laura's student was one of my greatest blessings and I use the knowledge and skills she taught me every day. In terms of her contribution to this particular manuscript, anyone who has conducted a randomized trial with school personnel will appreciate the quality of relationships and level of trust needed to execute a state-wide investigation of school leaders. Laura's leadership skills were tremendous, and this project could not have been carried out successfully without her guidance.

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