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Mathematics Instructional Leadership: Self-Efficacy Development for Elementary School Administrators

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ABSTRACT

To optimize teacher support, administrators need subject-specific knowledge, skills, and beliefs to lead, not just manage, instructional change. Professional development (PD) is needed with the many roles administrators are already called to fill. In this study, 38 elementary administrators participated in PD in mathematics instructional leadership. Findings from the Administrator Self-Efficacy Survey for Mathematics, derived from the Principal Self-Efficacy Survey (Smith & Guarino, 2005), show that subject-specific, district-led PD designed around sources of self-efficacy (Bandura, 1977, 1982, 1986) had a significant impact on increasing administrators' mathematics instructional leadership self-efficacy. Specifically, administrators increased their beliefs to influence effective mathematics practice, apply district PD to instructional leadership practices, and justify change during reform. These results show promise for future mathematics-specific instructional leadership development. Results from this study can inform PD design for districts and leaders aiming to promote and support school administrators as instructional leaders and advocates for evidence-based practice.

***Keywords*:** Instructional leadership, self-efficacy, professional development, mathematics

Elementary administrators serve in a variety of roles, including that of instructional leader within their buildings. Instructional leadership is a core responsibility for educational leaders (Leithwood & Louis, 2012; National Policy Board for Educational Administration, 2015) and has an indirect, but significant impact on student learning and school improvement (Grissom et al., 2021; Hallinger, 2011; Hallinger & Heck, 1998; Leithwood et al., 2010, 2004). Thus, school districts must support administrators with the professional development (PD) necessary to enhance the knowledge, skills, and dispositions needed to manage and lead change. PD is especially critical when administrators are charged with implementing philosophically different curriculum and instructional practices; therefore, PD design and implementation should be carefully examined. For example, the philosophical and instructional climates of elementary mathematics education have experienced immense change over the past decade. As school districts look toward curriculum reform, they face factors that may interrupt curriculum-as-intended without administrator leadership (Lai, 2015). The authors, a mathematics teacher educator and educational leadership faculty member, hypothesize that for school administrators to enact instructional leadership actions in subject-specific areas, they must first develop their leadership self-efficacy (LSE) beliefs in their ability to lead with a strong background in the subject area. Therefore, this manuscript examines the following research question: What is the impact of subject-specific professional development on elementary administrators' beliefs in their ability to lead mathematics curriculum change as instructional leaders?

LITERATURE REVIEW

"Leadership is second only to classroom instruction among all school-related factors that contribute to what students learn at school" (Leithwood et al., 2004, p. 5).

Over the past two decades, research and policy have expanded the role of administrators within K-12 school buildings. With limited resources, building administrators are expected to wear many hats and continuously make progress on school improvement plans. Findings suggest that how administrators approach their role as school leaders directly affects their schools' outcomes. Specifically, their roles fall into four main areas: (a) engaging as an instructional leader, (b) building a productive climate; (c) facilitating collaboration and professional learning communities; and (d) managing personnel and resources (Grissom et al., 2021). Administrators must balance the responsibilities of developing a shared vision, motivating stakeholders, implementing change initiatives, and monitoring progress. Their role becomes even more complicated when faced with large-scale change that may bring new philosophical beliefs and practices (e.g., curriculum reform). Such reforms are frequently district-led and may seem externally imposed on a school or classroom. The school administrator, then, must be a champion for change and work to align or modify previous school policies and practices with upcoming curriculum changes (Fullan et al., 2016). That is, the leader must simultaneously be an instructional leader and a champion for change.

There are conditions, however, that need to be in place for administrators to successfully enact change. First, school administrators must be fully engaged in reform efforts as the building level agent of change for sustainability over time (Elmore, 2004; McLaughlin & Talbert, 2002). Second, administrators must consider the values, fears, and goals of teachers and the organization to build capacity in the individuals for continuous change, growth, and persistence through obstacles (Senge, 1999). Third, they must anticipate the varying levels of teachers' acceptance and willingness to implement change (Hall & Hord, 2011).

Due to the complexity of this work, PD is needed to support administrators in enacting change. Administrative PD is aimed at increasing the capabilities of leaders to create and support conditions in schools where quality teaching and learning are possible (e.g., Hallinger & Heck, 2011; Hauserman & Stick, 2014). The most effective PD models focus on content and student understanding (e.g., Desimone, 2009; Guskey, 2002) and guide administrators in comprehensive, substantiated, and intensive training to improve student achievement (Wei et al., 2009). This requires deep reflection on what administrators already know and believe about teaching and learning, as opposed to broad, unfocused PD coupled with expectations of immediate results to matriculate to student learning outcomes (Guskey, 2000). For example, administrative PD that is connected to daily work has been shown to have a significant relationship between administrators' time spent on instructional leadership tasks and their ability to engage their teachers to improve instruction (Augustine et al., 2009).

Math Instructional Leadership

Current research on effective mathematics teaching and learning focuses on the promotion of conceptual understanding and reasoning, as well as skill fluency, in collaborative learning environments (NCTM, 2014; NCTM, 2020). Gone, in theory, are the days of math tricks masquerading as math instruction. This can be different from how many teachers and administrators experienced mathematics as learners. The National Council of Supervisors of Mathematics (NCSM, 2008) stated that "mathematics programs will only get better when leaders open themselves and other teachers to new ideas, risk imaginatively, and enthusiastically inspire those they lead with a desire to learn and grow together" (p. 56). However, research has shown that while an administrator's vision for teaching and learning is a key factor in predicting standard-based expectations, developing their vision is relatively difficult in mathematics in comparison to other subject areas (Katterfield, 2014).

Although administrators are expected to be instructional leaders more broadly, it is critical for them to have a strong understanding of the current mathematics practices important to reinforce effective instruction within their building (NCSM, 2008; NCTM, 2014). Administrators are called to be active, rather than passive, instructional leaders as they face philosophical changes in culture and practices (NCTM, 2020; Nelson; 1999). Supervision of classroom teaching and learning is considered a core administrative leadership behavior (Leithwood & Louis, 2012); however, for supervision of mathematics to be effective, administrators must have a basic understanding of (a) the content area, (b) how teachers teach and learn about mathematics, and (c) how students learn mathematics (Stein & Nelson, 2003). For each of these areas, this implies current knowledge as mathematics education teaching and learning research is a highly investigated field of study. For example, research has shown that administrators with a well-established and shared vision for what high-quality mathematics instruction should be and how to get there are better equipped to influence effective practices as a building-level issue (Coburn, 2005; Nelson & Sassi, 2003).

Subject-area leadership, therefore, provides an important context for administrators' work in times of change (Burch, 2007; Spillane et al., 2001). Districts must provide opportunities to grow in subject-area leadership because administrators with subject-specific knowledge and knowledge of how students learn those subjects have a significant advantage as instructional leaders (Munter, 2014; Nelson & Sassi, 2003). These administrators are able to frame instructional

conversations with their teachers around subject specific (e.g., math) practice using common language and tools. These conversations provide all stakeholders with clearly defined next steps toward instructional goals to improve overall teaching and learning in their building (Boston & Steele, 2014). When administrators are considered knowledgeable and collaborate with teachers, they are better able to challenge the existing culture of instructional practices, especially in areas like mathematics, with a compelling vision for improving instruction (Nelson & Sassi, 2003; Philips, 2021).

Theoretical Framework: Self-efficacy

Developing leaders involves helping them see who they are, what they value, and how their actions affect both other individuals and their organization's environment. Bandura's Social Cognitive Theory defines self-efficacy, the theoretical framing of this study, as an individual's beliefs in their capabilities to achieve a specific task and how their beliefs shape their thoughts, emotional state, and actions in response to challenging situations (Bandura, 1986; Stajkovic et al., 2018). When individuals believe they have the capacity to produce a desired result, they are more likely to take action to make it happen (Bandura, 1997; Kleinsasser, 2014).

It is vital that school administrators can learn to enact and lead change with attention to leadership self-efficacy beliefs to establish their school's vision, adapt and implement change, and persist through obstacles (Bandura, 1986; Gist & Mitchell, 1992; McCormick, 2001). For administrators in particular, a strong sense of self-efficacy as instructional leaders has been found to positively impact their engagement in schools (Federici & Skaalvik, 2011, 2012). Further, administrators' beliefs in their ability to lead instruction (known as instruction leadership self-efficacy) is highly correlated with school administrator behavior (Leithwood & Jantzi, 2008) and improving teacher self-efficacy (Ma & Marion, 2021; Cansoy & Parlar, 2018).

Particularly important to the self-efficacy construct is that beliefs can be grown and enhanced. When implementing PD, self-efficacy then becomes a unique area to measure in terms of change over time and after interventions or training. Further analyzing self-efficacy as a construct, research has found that there are four sources that can influence an individual's beliefs in their ability to accomplish a task: (a) performance outcomes (enactive mastery experience), (b) vicarious experiences (watching others), (c) verbal persuasion, encouragement and feedback, and (d) attention to psychological state (Bandura, 1977). These sources provide insight about how to enhance the self-efficacy of individuals, in this case, leaders enacting change in schools.

According to Bandura (1997), *performance outcomes*, or enactive mastery experience, is the most powerful source of self-efficacy. Enactive mastery experience is defined as the "experience overcoming obstacles through perseverant effort" (Bandura, 1997, p. 80). Both positive and negative experiences can impact an individual's self-efficacy; however, if tasks are viewed as futile or insignificant, the impact on self-efficacy is often minimal. *Vicarious experiences* are defined as "learning mediated through modeled attainments" (Bandura, 1997, p. 86). By watching others attempt to complete a task, individuals can develop their own high or low beliefs in their ability to be successful. If an individual observes someone similar to them succeed, it can positively affect his/her efficacy. If an individual views someone similar to them fail, this can lower self-efficacy in that the individual's thinking questions their own ability to succeed if they believe others similar to themselves can't (Bandura, 1977). *Verbal persuasion*, in the form of interpersonal support provided by peers, supervisors, and the community, can impact self-efficacy beliefs as individuals are led to believe they can achieve success on a given task (Tschannen-Moran & Woolfolk-Hoy, 2007; Tschannen-Moran et al., 1998). When feedback in the form of encouragement or coaching is given, individuals feel they are more capable of achieving success than originally thought possible; hence, increased self-efficacy (Paglis & Green, 2002). Verbal persuasion is the most highly utilized of the four sources of self-efficacy in schools for both teachers and students, yet it is statistically the least effective, with gains of efficacy beliefs being "weak and short-lived" (Bandura, 1997, p. 82). The last source of self-efficacy identified by Bandura is *attention to psychological or emotional state*. As individuals experience emotional arousal such as agitation, anxiety, and/or excitement, their interpretation of these psychological states can influence their efficacy beliefs (Bandura, 1977). In educational settings, learning is enhanced when the mood of the individuals (students, teachers, administrators, etc.) correlates with their psychological state. This is evident for both increasing and decreasing efficacy beliefs (Bandura, 1997). An individual's mood affects the way he/she interprets and evaluates events and information (Kavanagh & Bower, 1985). This understanding of the psychological and emotional role as a source of self-efficacy can be useful in coordinating learning experiences where individuals feel at ease and can attain higher self-efficacy beliefs.

In research conducted on teacher self-efficacy, Labone (2004) found that overall self-efficacy is enriched through a combination of these four identified sources as each source contributes in a unique way to an individual's sense of confidence in their ability to complete a task. For district leaders and researchers, the knowledge and utilization of this

powerful construct could translate training into action with increased fidelity due to self-efficacy's relationship to human behavior. Research shows that individuals with higher leadership self-efficacy use their emotions (e.g., psychological state), whether excitement or stress, as a motivator of performance. On the other hand, individuals with lower self-efficacy interpret their emotions as debilitating (Bandura, 1997).

One consideration of this research is to proactively design PD experiences for administrators to attend to administrators' instructional leadership self-efficacy as they aim to enact change. Self-efficacy can influence and be influenced within organizations and affects factors such as job satisfaction and school climate and culture (Puja Kesuma et al., 2021). Previous research on the use of self-efficacy sources in PD design has been examined for teachers (e.g., Tschannen-Moran & McMaster, 2009); however, there is a dearth of evidence related to educational leadership development through the lens of self-efficacy (Versland, 2016). This study, situated in one Midwestern school district, aims to examine the impact of subject-specific PD, designed around the self-efficacy sources, on administrators' instructional leadership beliefs as leaders of change.

METHOD

This study is a pre-experimental design (Creswell, 2009) in which the researchers studied one group before and after a yearlong PD intervention. A single survey measured both school administrators' general instructional leadership self-efficacy (GLSE) and their mathematics instructional leadership self-efficacy (MLSE). Two phases of data analysis occurred: 1) pre-test, post-test of composite group survey results for both GLSE and MLSE, and 2) an item-level analysis of the mathematics survey items.

Participant Sample

Thirty-eight elementary administrators participated in mathematics-specific PD during a curriculum implementation year. Elementary administrators represented each of the district's 25 elementary school buildings and included 13 administrative interns (assistant principals). Administrators had varying years of both teaching and administrative experience. A total of 24 survey respondents, on both the pre- and post-surveys, reflect a 63% response rate. Researchers administered pre-surveys prior to the curriculum implementation year. Post-surveys occurred after one full year of district-led, mathematics-specific elementary administrator PD. Surveys utilized in this research study were administered concurrently with other anonymous district-requested formative feedback. Anonymous feedback is part of the district's regular program improvement practice to promote open and honest feedback. For consistency and at the request of the district research office, the survey instrumentation for this study also maintained administrator anonymity. Thus, pairing of pre- and post- surveys was not an option and is identified as a limitation of the study.

Intervention Description

As a result of stagnant elementary mathematics state test results, a Midwestern suburban public school district developed a yearlong mathematics-specific PD model for administrators. A critical look inward on math practices revealed that many previous curriculum-aligned practices (e.g., homogenous grouping by ability) contradicted empirical research findings related to equitable and effective instructional practices for mathematics (NCTM, 2014). Through research and analysis of student achievement data, a significant shift in curriculum and instructional design was on the horizon, and it was vital in driving the future district mathematics work.

The district-led PD was specifically designed (Gomez Johnson, 2017) to support all four sources of self-efficacy: (a) performance outcomes (enactive mastery experience, PO); (b) watching others (vicarious experiences, WO); (c) verbal persuasion, encouragement, and feedback (VP); and (d) attention to psychological and emotional state (PE) (Bandura, 1977). All four sources were framed within the mathematics context, thus intending to increase administrators' mathematics instructional leadership self-efficacy (MLSE). Administrators completed monthly "homework" such as co-planning or teaching a math lesson from the new curriculum with a building teacher (PO). They also participated in video analysis of teaching to observe and reflect about mathematics teaching in the district (WO), networked with peer administrators at monthly meetings (VP), and shared their experiences, challenges, and successes with district leaders and peers (PE).

Survey Instrument

The survey used in this study, the Administrator Self-Efficacy Survey for Mathematics (ASES-M), is a derivative survey of Smith and Guarino's (2005) Principal Self-Efficacy Survey (PSES). The ASES-M survey consists of three distinct

4-point Likert scale sections (Table 1) with responses ranging from (1) *very weak beliefs in my abilities* to (4) *very strong beliefs in my abilities*. Internal consistency of the instrument was measured using Cronbach's alpha based on general instructional leadership self-efficacy (GLSE) (items 1-10) and mathematics instructional self-efficacy (MLSE) (items 11-28) with coefficients of .806 and .962, respectively. Survey scales with alpha levels above 0.70 are considered internally consistent (Nunley, 1978). These reliability statistics indicate a high level of internal consistency on the scale given a specific sample. Three open-ended questions concluded the pre- and post- surveys to gather participant's perceptions of effective mathematics instruction and their PD experiences.

Table 1

Administrator Self-Efficacy Survey for Mathematics Question Breakdown

Items	Type	Self-efficacy Type	Description
1-10	4-point Likert	general	Based on a subset of Smith & Guarino (2005) PSES instrument and provides insight on General Instructional Leadership Self-Efficacy
11-20	4-point Likert	mathematics	Derived and mirrored on questions 1-10 with inclusion of "mathematics" on each item and provides insight on Mathematics Instructional Leadership Self-Efficacy
21-28	4-point Likert	mathematics	Co-constructed with district leaders to gather specific district professional development self-efficacy data
29-31	Open-ended		For participants to expand on professional development components and individual perspectives.

Researchers used both GLSE and MLSE composite scores for this study. The GLSE composite score was generated from questions 1–10. The MLSE composite score was generated from math-specific questions 11–28

RESULTS

Researchers analyzed survey response data using SPSS, version 11. To understand the impact of mathematics-specific PD on elementary school administrators' self-efficacy, the pre-test post-test composite score GLSE (Table 2) and MLSE (Table 3) were analyzed using independent samples t-tests.

Table 2

General Instructional Leadership Self-Efficacy Composite (GLSE)

	Pre-Survey		Post-Survey			
	M	*SD*	*M*	*SD*	*t*	*df*
General Instructional Leadership Composite (Questions 1-10)	31.79	3.72	34.00	4.02	-1.956 (.057)	45

Findings reveal that PD did not make a significant difference in the GLSE of administrators ($t(45) = -1.956$, $p > .05$).

Table 3

Mathematics Instructional Leadership Self-Efficacy Composite (MLSE)

	Pre-Survey		Post-Survey			
	M	*SD*	*M*	*SD*	*t*	*df*
Mathematics Instructional Leadership Composite (Questions 11-28)	55.25	6.48	59.63	7.81	-2.113 (.040*)	46

Findings reveal that there was a significant difference in MLSE ($t(46) = -2.113$, $p < .05$) from pre-survey ($M = 55.25$, $SD = 6.48$) to post-survey ($M = 59.63$, $SD = 7.81$). Administrators' mathematics instructional leadership self-efficacy was significantly improved as a result of the mathematics-specific PD designed around the four sources of self-efficacy.

Next, researchers analyzed mathematics-specific individual survey items for further understanding. There were three statistically significant item differences in administrators' pre-MLSE to post-MLSE (Table 4).

Table 4

Mathematics Instructional Leadership Self-Efficacy as measured by ASES-M, questions 11–28

	Pre-ASES-M (n = 24)		Post-ASES-M (n = 24)		Independent Samples *T*-test (n = 24)		
Administrators' Beliefs in their ability to:	*M*	*SD*	*M*	*SD*	*df*	*t*	Sig. (2-tailed)
Influence teachers to utilize effective mathematics teaching and learning practices	2.96	.47	3.42	.65	46	-2.80	.007**
Provide effective modeling for teachers regarding effective mathematics teaching and learning practices	2.88	.80	3.17	.56	46	-1.46	.150
Use research on mathematics teaching and learning practices to guide strategic planning for accomplishment of school goals	2.92	.78	3.21	.66	46	-1.405	.167
Plan effective activities and experiences which impact teachers' beliefs in their abilities to provide effective mathematics teaching and learning activities to their students	3.00	.78	3.33	.64	46	-1.621	.112
Use data collected from teacher observations to inform school-wide efforts for improving mathematics teaching and learning	3.25	.61	3.46	.66	46	-1.139	.260

Regularly perform effective observations of teachers specific to mathematics instruction	3.13	.68	3.38	.58	46	-1.375	.176
Stay abreast of current best practices for facilitating effective mathematics teaching and learning	2.79	.66	3.17	.64	46	-2.01	.051
Communicate mathematics needs and goals necessary to enhance effective instructional effectiveness to faculty	3.29	.46	3.42	.65	46	-.764	.449
Provide experiences that foster and facilitate high levels of teacher motivation towards teaching and learning mathematics	3.00	.59	3.17	.56	46	-1.00	.323
Protect instructional time so that effective mathematics teaching and learning can take place	3.25	.61	3.46	.66	46	-1.139	.260
Apply district professional development to instructional leadership practices	3.17	.57	3.54	.51	46	-2.417	.020*
Provide feedback using consistent mathematics language regarding effective teaching and learning practices	3.04	.55	3.25	.61	46	-1.245	.219
Lead mathematics conversations with teachers following instructional observations	3.25	.79	3.21	.72	46	.190	.850
Lead conversations with teachers about how students learn mathematics	3.04	.69	3.17	.70	46	-.622	.537
Motivate teachers mathematically to reflect on their knowledge, skills, and dispositions regarding effective mathematics teaching and learning	3.00	.66	3.25	.61	46	-1.366	.179
Recognize mathematical errors or misconceptions during instruction	3.04	.91	3.38	.58	46	-1.519	.136
Justify change in mathematics teaching and learning during curriculum reform	3.08	.58	3.46	.59	46	-2.217	.032*
Implement or co-teach a mathematics lesson for students	3.17	.87	3.21	.59	46	-.195	.847

The first significant finding is an increase in administrators' beliefs in their ability to influence teachers to utilize best practices in mathematics teaching and learning ($t(46) = -2.80$, $p < .01$). Second, administrators increased their beliefs in their ability to apply district-led PD to their instructional leadership practices ($t(46) = -2.417$, $p < .05$). Last, administrators noted significant increases in self-efficacy after PD in their ability to justify changes in mathematics teaching and learning during reform ($t(46) = -2.217$, $p < .05$).

These three instructional leadership items reinforce the leader's capacity for change during reform. Overall, findings show that administrators increased aspects of their beliefs in their ability to lead instructionally following PD. Administrators increased their beliefs in translating their own professional learning to mathematics instructional leadership practice.

Limitations

Self-efficacy is a construct measured by self-perception. Because perception is not a static process and can be molded based on changing experiences, the tool used in this study, and all perception studies, may not be sensitive enough to honor multi-facets of identity and experience. Impact of PD can also be measured using student test scores. Reliable test data was not available for this study due to testing inconsistencies during the COVID-19 pandemic. While the initial findings of this pre-experimental study are promising, this study was conducted in one Midwestern suburban school district and the findings are not yet generalizable. Also, the survey data were not individually identifiable; thus, the pre-post analyses were limited to independent groups *t*-test statistic. Elementary administrators were asked to provide critical feedback, share their professional successes and struggles, and complete the ASES-M. All personal responses were anonymous. While anonymous responses are one way to encourage honest feedback, the tradeoff resulted in a less powerful analyses. The authors recognize the use of a paired sample *t*-test would be stronger and would reduce inter-subject variability. If using a paired-samples dependent *t*-test, the results might have found additional statistically significant results.

DISCUSSION

Administrators, as the bridge between district and building-level initiatives, are in a unique position to impact and drive change (Stein & Nelson, 2003). Previous research supports those administrators with a well-established and shared vision of high-quality mathematics instruction are better equipped to influence effective practices within their buildings (Coburn, 2005; Nelson & Sassi, 2003). This study found that mathematics-specific PD, designed around Bandura's four sources of self-efficacy, significantly increased administrators' beliefs in their ability to be instructional mathematics leaders. Findings confirm that more attention on mathematics-specific PD can have a positive impact on administrators' belief in their ability to organize and execute leadership tasks (e.g., Labone, 2004)—that is, lead mathematically.

Elementary administrators re-evaluated their conceptions of high-quality mathematics instruction based on empirical evidence rather than solely on traditionally accepted mathematics practices or the former curriculum structures. Through the PD process designed around the sources of self-efficacy, administrators had tools and access to opportunities to practice how they would lead mathematics reform in their building. Administrators gained understanding of how they could support a variety of stakeholders in adjusting to the philosophical shift in thinking about mathematics teaching and learning. Their ability to justify change, a significant finding of this study, is vital for administrators especially when leading a variety of initiatives in their building (Elmore, 2004; McLaughlin & Talbert, 2002).

In this study, elementary administrators specifically increased their beliefs in their ability to influence effective mathematics practices, apply district PD to instructional leadership practices, and justify change in mathematics practices during reform. These specific beliefs are invaluable for leaders as they take on the role of change agents. As one participating administrator stated, "It would have been difficult to get staff buy in without having authentic buy in myself." To move a school or district toward sustainable improvement calls for collective effort involving leadership, teachers, students, and families. Administrators as building leaders set the tone for how change will be managed and motivated (Grissom et al., 2021) and, therefore, require PD opportunities to equip them with the beliefs, knowledge, and skills necessary to lead so that others will follow.

Building administrators are essential to successful student learning and student achievement (Grissom et al., 2021; Leithwood et al., 2010; Marzano et al., 2005). For school districts investing large amounts of time and money into new curriculum materials, districts need to position leaders with agency to reinforce best practices and empower teachers on a cohesive district instructional vision. In contrast, lack of cohesion among teachers and administrators could lead to gaps in student learning and fragmented reform (Fullan et al., 2016). Beyond managerial expectations to suggest change, administrators with increased beliefs in their ability to influence stakeholders (e.g., teachers, parents) are more likely to

enact change. This study's findings support previous research stating empowered and informed administrators are more likely to be active participants in the reform process (Nelson, 1999).

The changing landscape of mathematics education and other curriculum reform environments require administrators to be fully engaged and equipped to lead sustainable change (Elmore, 2004). Twenty-first century administrators are expected to be transformative leaders and champions of change as they plan and implement specific programs and PD in their buildings (Hargreaves & Fullan, 2009; Leithwood & Day, 2010; NPBEA, 2015). However, administrators must be equipped with the knowledge, skills, and dispositions to translate best practices, in areas like mathematics, to their building mission and goals. Without thoughtful consideration about the leaders enacting change, the level of persistence and overall success of reform could be negatively impacted (Senge, 1999).

This study reveals that with intentional PD design that is subject-specific, significant gains can be made in administrators' beliefs about their ability to lead in subject-specific ways. Therefore, PD designed around self-efficacy sources provide a unique opportunity for further research (Supovitz et al. 2010), especially during change. Self-efficacy is a powerful construct and lens to examine PD as it has been proven to connect cognition, motivation, and behavior through individual beliefs (Bandura, 1986). The four sources of self-efficacy attainment can provide a clear roadmap to design meaningful activities and experiences in PD environments. In this study, district leaders and researchers collaborated to provide administrators with opportunities to practice (performance outcomes) and watch others enact mathematical instructional leadership actions (vicarious experiences) in a variety of ways. Additionally, administrators met regularly in an environment where they were encouraged to take risks all while being provided encouragement and feedback with attention on their psychological and emotional state.

The combination of self-efficacy sources in PD should not be overlooked as impactful features of reform as they enrich the overall beliefs of individuals (Labone, 2004). After the year-long PD, administrators in this study were armed with increased mathematics instructional self-efficacy (MLSE) to help them lead strategically, engage with intention, and persist despite obstacles. Rather than look to external sources to influence best practices of mathematics in their building, with increased self-efficacy, they are positioned to take on mathematics instruction as a building-level issue (Coburn, 2005; Nelson & Sassi, 2003). With each building representing diverse student, teacher, and community needs, having administrators who are supported with PD and increased beliefs in their abilities to lead in their context is critical. This research continues the conversation that empowered administrators have influence on championing change and school improvement. When PD is carefully designed for leaders around mathematics self-efficacy, it can impact how administrators believe they are able to influence, apply, and justify change—a powerful triad as they navigate the complexities of their role in education.

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