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The Principal's Impact on the Success of Mathematics Professional Development

Michael Chad Staheli

A dissertation submitted to the faculty of
Brigham Young University
in partial fulfillment of the requirements for the degree of

Doctor of Philosophy

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ABSTRACT

The Principal's Impact on the Success of Mathematics Professional Development

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Doctor of Philosophy

Principal involvement is recognized as a key component to success in professional development implementation. Both the principal efforts undertaken, and the visions stated influence teacher development and student achievement. Using the instructional, transformational, and learning-centered models of leadership, as well as frameworks in vision, and organizational theory, this research sought to clarify the impact of principal involvement on student performance. Interview data was collected from 16 principals participating in a mathematics professional development program entitled the Comprehensive Mathematics Initiative. Of the participants, 9 of the principals were from schools that achieved high levels of student performance on standardized mathematics tests following their school's participation in the professional development program. The remaining 7 principals achieved moderate success from participation in the same. General findings suggest that principals who pursue a learning-centered leadership model (combining both instructional and transformational leadership efforts) achieve greater success while implementing professional development programs. Specific findings identified that principals who define success in terms of improving student performance were more likely to achieve higher student achievement on mathematics standardized tests versus those principals who define a metric of success as stronger teacher development. Additionally, it was determined that vision statements expressed with brevity and a singular goal were more effective at influencing student achievement than more complex, multi-faceted visions. Finally, efforts taken to involve staff in decision making and encourage teacher development through supportive means were more successful at achieving higher levels of student performance. These findings can inform principals and other school leaders on how to more effectively implement professional development programs.

Keywords: professional development, transformational leadership, instructional leadership, vision, mathematics

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To Grace, Mike, Owen and Henry. They know no other reality than a father in school. They are my happy place. I hope they have seen the sacrifice required to pursue education and lofty goals, coupled with the knowledge that they will always be worth more.

To my dad who taught me by example that anything of value requires hard work, and to a mother who taught me to seek for balance and the humor in all things.

My dissertation committee who provided critical guidance just when needed. Without each's willingness to participate and adjust schedules, this dissertation would not be possible.

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DESCRIPTION OF DISSERTATION STRUCTURE

The hybrid dissertation is one of the formats accepted within Brigham Young University's McKay School of Education. The final product is intended to highlight a journal-ready manuscript in conformity with the submission requirements of my target journal—*Educational Administration Quarterly (EAQ)*. The target audience for the EAQ is made up of both practitioners and academics focused on educational leadership. The manuscript length for submission is 25–40 pages. Introductory pages as well as the study related appendices are provided in order to fulfill the dissertation requirements of the University. The extended literature review included in Appendix A provides a broad overview of literature related to this study. The next four appendices provide study specific detail including an extended description of methods used (Appendix B), the consent form completed by each participant (Appendix C), study instruments relied on including an outline of the interview questions (Appendix D), and the University's Institutional Review Board approval to conduct this study with human participants (Appendix E). Two reference lists are provided, one intended for *EAQ* submission, the other as Appendix F supporting the appended extended literature review and extended methods.

Background

Educational stakeholders desire schools maintain or achieve high levels of student performance (Hanushek, 1986; Rutter, Maughan, Mortimore, Ouston, & Smith, 1979). This performance has been attributed to the quality of the education provided (Darling-Hammond, 1999; Harris & Sass, 2011; Kukla-Acevedo, 2009). In order to achieve this desired goal, schools often require change. Principals drive school change (Bryk, Sebring, Allensworth, Easton, & Luppescu, 2010). Despite the expectations that are placed on principals, scholarly acknowledgement of their effect has not always been highlighted in literature. Recognizing that "the role of principal has swelled to include a staggering array of professional tasks and competencies" (Davis, Darling-Hammond, LaPointe, & Meyerson, 2005, p. 3) recent studies have started to "give overdue recognition to the critical role and mounting demands on school principals" (Davis et al., 2005, p. 1). In other words, principals have an impact on the schools they lead. In fact, it is suggested that leadership is second only to classroom instruction as a primary influence on student academic achievement (Leithwood & Jantzi, 2008).

Many believe that leaders' adoption of professional learning communities (PLCs) are the most effective way to improve schools by supporting teachers in their efforts to influence student performance (Blankstein, 2004; DuFour & Eaker, 2009; Louis & Kruse, 1995; Louis & Marks, 1998). This study does not review the elements of a successful PLC other than to acknowledge that principals have the capacity to affect their implementation (Hallam, Smith, Hite, Hite, & Wilcox, 2015; Supovitz, Sirinides, & May, 2010; Wahlstrom & Louis, 2008). The purpose of this study is to explore the principal impact on student achievement within the context of elementary schools PLC's implementation of professional development focused on mathematics.

Models of Leadership

Research focused on the impact of principal leadership within their schools has been conducted for decades with multiple leadership theories and suggested practices emerging including the "instructional" and "transformational" leadership models. Early instructional leadership theory originated in the 1980s and describes an emphasis on the learner as leaders engage in efforts to promote better measurable outcomes for students through curriculum planning as well as pedagogical improvement and evaluation (Day, Gu, & Sammons, 2016; Hallinger, 2003; Marks & Printy, 2003). Transformational leadership originated in research proposed in the 1990's and is rooted in an organization-focus with an emphasis on the "process of leadership that raise organizational members' levels of commitment and shape organizational culture" (Goldring, Porter, Murphy, Elliott, & Cravens, 2009, p. 5). While instructional leadership originated in the educational setting, transformational leadership theory has broader application across several types of organizations including schools, military, and business (Bass & Riggio, 2006). This study looks at each leadership model and generally categorizes the instructional model as "student-focused" and the transformational model as "teacher-focused." In other words, the differences between these two models is largely a first-order question, whether the primary focus is centered on the teachers, often described as mediating variables to student performance, or whether the focus is on developing student capacity directly.

An amalgamation of these two philosophies has emerged in recent years as a *leadership for learning* or a *learning-centered leadership* approach, a model positing that by combining instructional and transformational practices, a principal's impact on student achievement can be enhanced (DuFour, 2002; Goldring et al., 2009; Hallinger, 2011; Hallinger & Heck, 2010; Knapp, Copland, Honig, Plecki, & Portin, 2010; Knapp, Copland, & Talbert, 2003; Marks &

Printy, 2003; Murphy, Elliott, Goldring, & Porter, 2006; Robinson, 2010). There is current debate on the appropriate blend of instructional versus transformational leadership efforts that should exist in order to maximize student performance.

Instructional leadership focus. The quantitative meta-analysis of Robinson (2009) suggests that a greater focus should be placed on instructional leadership methods, concluding that its effect on student outcomes is a multiple of three or four times greater than that of transformational leadership. Their prior research found that "the closer educational leaders get to the core business of teaching and learning, the more likely they are to have a positive impact on students' outcomes" (Robinson, Lloyd, & Rowe, 2008, p. 664). Additional studies have identified that principals who implement instructional leadership behaviors have been found to positively impact student achievement more than those who express other leadership styles (Boyce & Bowers, 2018; Hallinger & Heck, 1996; Heck & Hallinger, 2009; Marks & Louis, 1999; Marks & Printy, 2003; Robinson et al., 2008; Seashore Louis, Dretzke, & Wahlstrom, 2010).

Transformational leadership focus. Other researchers suggest that organizational management efforts "appear very important, even more important than those associated directly with instruction" in the context of school success (Horng, Klasik, & Loeb, 2010, p. 521). These researchers identify the instructional leadership model as too narrowly defined, and instead, promote an emphasis on the virtues of a managerial focus. While Horng and Loeb (2010) ultimately suggest a blended model, they place a significantly heavier weight on transformational theory. Their analysis of multiple representative studies "consistently find that schools demonstrating growth in student achievement are more likely to have principals who are strong organizational managers" (Horng & Loeb, 2010, p. 67). In other studies, transformational

leadership has been identified as an effective catalyst for culture and environment change in schools undertaking a significant reform effort (Leithwood & Jantzi, 2006) and for those seeking improvement with teacher and staff relations (Bogler, 2005; Griffith, 2004). While the link between teacher commitment and self-efficacy to transformational leadership has been validated, many of these same researchers acknowledge a relatively weak relationship between transformational leadership and student academic performance (Leithwood & Jantzi, 2006; Ross & Gray, 2006).

A blended learning-centered leadership focus. Despite research arguing for a singular emphasis on either approach, some suggest that neither leadership style should be over-emphasized, and that there is no empirical evidence from current research to suggest that an "overrigid distinction between transformational leadership and instructional leadership" in either direction, will result in a more significant effect on student performance (Day et al., 2016, p. 225). Many researchers now propose a learning-centered leadership model that encompasses elements of both instructional and transformational theories (DuFour, 2002; Goldring et al., 2009; Liu, Hallinger, & Feng, 2016; Murphy et al., 2006; Robinson, 2010). Support for this blended approach concludes that "when transformational *and* [emphasis added] shared instructional leadership coexist[s] in an integrated form of leadership, the influence on school performance, measured by the quality of its pedagogy and the achievement of its students, is substantial" (Marks & Printy, 2003, p. 370).

In summary, current research generally acknowledges the benefits of a blended learning-centered leadership approach, but there is no consensus of how, or whether, this blend should be weighted towards instructional or transformational efforts. There is no agreement in the literature on whether these leadership styles are distinctly separate, or whether transformational is a subset

of instructional leadership in the new learning-centered leadership theories. Additionally, while the principal impact on student performance is presented heavily in the literature, it is acknowledged this effect is indirect. Principals affect teachers, who in turn, directly affect students.

The purpose of this study was not to identify a precise mix of leadership styles to maximize student performance, but rather to add to the current literature suggesting the blended learning-centered leadership approach may be an effective mechanism for principals to maximize their impact on student achievement.

Principal Vision

One attribute in multiple leadership theories, including transformational and instructional leadership, is an emphasis on the importance of the development and pursuit of a vision (Hallinger & Heck, 2002; Robinson et al., 2008). Vision statements are not universally defined constructs in literature. The term is used to describe multiple phenomena (the force molding meaning for people within an organization (Mariasse, 1985); a goal-oriented mental construct (Seeley, 1992); a formative force field leaders can use to create a power (Wheatley, 1999)). Vision statements may be used in a variety of complex ways with a number of interchangeable terms such as personal agenda, purpose, legacy, dream, goal, mission, philosophy, and values (Kantabutra & Avery, 2002, 2007; Rahimnia, Moghadasian, & Mashreghi, 2011). Regardless of which term is used, it is generally accepted that vision is an important prerequisite for positive change within an organization (Barnett & McCormick, 2003; Daft & Lane, 2005). This study adopts the approach of Baum, Locke, and Kirkpatrick (1998) and Kantabutra (2003) in presenting “vision” as a term that each individual leader defines for their respective organizations instead of seeking for a universally accepted definition. Despite the various terms

that may be used, research has attempted to break down vision statements into measurable characteristics. Larwood, Falbe, Kriger, and Miesing (1995) identified ten meaningful vision attributes. Based on that list of ten items, others including Baum et al. (1998) and Kantabutra and Avery (2007) reduced the list to seven items—brevity, clarity, abstractness, challenge, future orientation, stability, and desire or ability to inspire.

The Comprehensive Mathematics Initiative Professional Development

Districts and schools nationally have implemented various programs over the years to develop students' mathematics understanding, with little to no meaningful or sustained impact on instructional methods or student achievement. Teachers often fail to fully recognize the value of developing a deep mathematical understanding in students. In many cases, teachers do not realize this level of understanding exists because they lack meaningful mathematical understanding themselves. Traditional mathematic professional development has not been highly effective in bringing about change in traditional systems because it fails to target the teachers' own deficiencies in mathematics (Cohen & Ball, 1999; Hendrickson, Hilton, & Bahr, 2008). Not surprisingly, this results in the inability for many teachers to develop a deep mathematical understanding in their students.

The Comprehensive Mathematics Instruction Professional Development (CMI PD) program was created, under the direction of Professor Sterling Hilton, as a collaborative project between Brigham Young University's math and education departments and multiple northern Utah school districts. The CMI PD provides K-12 mathematics instructors access to strategies designed to "bridge the gap between the good pedagogical strategies of traditional instruction and the recommendations of reform-based instruction" (Hendrickson et al., 2008, p. 3). It establishes a structure for teacher development, assisting them in transitioning to pedegogical

practices based on deep mathematics understanding versus the often relied on rote tools traditionally employed. This program requires a material culture shift at many schools, but can be effective in achieving the ultimate goal of developing student mathematics understanding.

The CMI PD utilizes the PLC structure allowing participants to work as teams at their respective schools in order to develop the capacity of each individual teacher by improving their understanding, attitudes and pedagogy with regards to mathematics. Leadership of the CMI PD includes an off-site facilitator (an expert in the CMI PD), an on-site facilitator (a teacher leader who attended summer training in the CMI PD), and the school principal. Teachers participate in the CMI PD by attending lesson study as a collective team each month in micro-sessions over a structured two-year period. The CMI PD relies on a program of mathematics instruction and pedagogy training, peer-reviewed practice, and peer classroom observation with subsequent follow-up. One of the strengths of the CMI PD is its ability not only to improve teachers' instructional skills, often referred to as human capital, but allows for the building of social capital identified by Leana (2011) as a more significant predictor of student achievement. Since 2004, over 45 elementary schools across Utah have participated in the CMI PD.

Significance of Research

The CMI PD is specifically designed to address the deficiencies in mathematics understanding. Principals often adopt and implement various professional development programs in order to address school deficiencies, but they may not fully realize the meaningful relationship between their involvement and a program's ability to ultimately improve student understanding. The need to have effective school leadership is vital and particularly acute in efforts to bring about radical schoolwide system change, as the CMI PD attempts. Whether large or small programs are implemented, scholars agree that principals have an impact on the success of those

programs and ultimately, on student performance. "[T]here is not a single documented case of a school successfully turning around its pupil achievement trajectory in the absence of talented leadership" (Leithwood, Harris, & Hopkins, 2008, p. 29). In this study, it is assumed that principals do indeed impact an implemented development program's success and thus seeks to answer the following questions:

- What types of efforts are characteristic of an effective school leader?
- Where should a principal's focus be if they want to maximize 'pupil achievement'?
- Can these efforts and focuses be categorized as instructional and/or transformational in nature in order to determine an ideal mix, thus supporting the blended learning-centered approach?
- Are there other findings providing potential explanation of how a principal affects student understanding?

A basic conceptual framework is provided in Figure 1 as a guide to determining this principal impact. The results of this study can be beneficial to school leaders and policy makers in future professional development efforts.

Conceptual Framework

The conceptual framework tested under this study centers around simple constructs founded on the theory that a principal's beliefs and efforts (expressed vision, role perception, actions, etc.) impact professional development (the CMI PD), ultimately resulting in increased teacher capacity (mathematics understanding). Principals can also directly affect teacher capacity outside the framework of professional development. This teacher improvement ultimately results in increased student understanding and capacity as measured by standardized test performance.

[Insert Figure 1 here]

Methods

Population and Sampling

It was determined that a semi-structured interview with principals whose schools had participated in the CMI PD would provide the best data from which answers to the study's research purposes could be derived. To that end, this study used a census approach to collect data from all principals whose schools had completed the CMI PD from 2004 (when the program was first piloted) to 2016 (when the study began). This resulted in a target population of 27 principals from 24 schools since three of the schools had two principals during the two-year CMI PD experience. While the vast majority of the target principals were no longer at their original participating schools, current contact information for 24 of the 27 principals was available. We initially contacted each of these principals via email and invited them to participate in the study. Subsequent emails and phone calls were made to the potential participants regardless of their reply to the introductory email. Ultimately, 16 principals agreed to participate in the study. Those not participating did not respond to the repeated requests or indicated unavailability due to time constraints. Each respondent was assigned a unique identifying pseudonym which is referenced in this study when an individual participant's comment or insight is used.

The 16 principals interviewed were located at elementary schools in five districts along the Wasatch Front across northern Utah and represent a diverse set of economic factors and demographic characteristics. School size varied and represented diverse socioeconomic environments with 8 of the 16 qualifying as Title 1 schools (see Table 1).

[Insert Table 1 here]

Approach and Procedures

Interviews were conducted over a six-month timeframe from March 2017 to September 2017. Study participants were interviewed in person at their administrative offices or remotely via webcam. All interviews were captured on video with a backup audio recording for subsequent transcription and observation of nonverbal cues. Participants responded to semi-structured questions designed to elicit responses which would provide the data to answer the questions posed in this study. For example, principals were asked specific questions such as "Describe how you prepared yourself and your faculty for the CMI PD in your school," and "What are the most significant things you did to contribute to the level of success your school achieved in CMI?" While both of these representative questions were asked of all participants, the order in which they were presented in the interview may have varied. Additionally, based on the particular responses provided, potentially unique follow-up questions were asked in order to more fully understand and capture the intent and detail underlying the original response or in order to explain and provide further clarification for perceived contradictions.

Our interviewer is not an employee of any school district, not considered a functional peer as a school administrator, and not directly associated with the implementation of the CMI PD at any school. This professional distance invited an open, less-threatening atmosphere which encouraged the respondents to provide an honest assessment of their experiences and insights regarding participation in the CMI PD. The interviewer avoided providing verbal or non-verbal affirming or condemning cues which would affect participant responses.

Research Design

An open-ended interview process was determined to be the most effective method of data collection for the study. An outline of potential questions was created. It was not anticipated that

the study would use the outline as a strict roadmap, but rather, the outline was used as a guide to facilitate deep, natural discussion sufficient to provide comparative data among subjects. Due to the changes to the CMI PD over time, questioning was focused only on those common elements that persisted across all implementations of the CMI PD over the 12-year span. For example, all implementations of the CMI PD incorporate implementation teams, lesson studies and observations. The research was also designed in such a way that the interviewer was not in a position of power or influence over the participants, thus aiding in the facilitation of honest and open responses.

As mentioned above, the principals in this study participated in the CMI PD over a 12-year period (see Table 2). Concerns regarding the potential memory biases based on the individual differences in the time since the CMI PD implementation were identified as an unavoidable limitation during the research design phase of the study. All efforts were made in the organization, structure, and content of the questions in order to elicit comparable responses and limit these memory biases.

[Insert Table 2 here]

Data Collection and Analysis

During the interviews conducted, open ended questions were asked of each research participant according to the general outline created in the research design phase of the study. Each interview was videotaped, transcribed, and analyzed using the research questions as a framework for examination. Each participant's transcript responses were entered into coding software and analyzed using a constant comparative method within and across cases in order to identify patterns and relationships (Eisenhardt, 1989). The initial rounds of open coding were guided by a focus on principal efforts, specifically, the expressed vision, role perception and

actions undertaken by each participant. Due to the emic nature of this study, subsequent rounds of open coding allowed expansion and deviation from these focuses. This process, validated through member checking, allowed responses to be organized into ever evolving parent, child, and grandchild nodes. Often, a new idea would emerge from a principal's responses late in the coding process necessitating a need to review all prior coded interviews in order to capture the same phenomenon. For example, initially the general brevity of the vision statements was not identified during the coding process, however, as a pattern of brief versus more complex statements was observed, prior coded transcripts were revisited to capture this idea.

Axial, and selective coding compared principal responses against the classification of the school as highly or moderately successful and allowed the data to be reconstructed in meaningful ways (Marshall & Rossman, 2010). In axial coding we compared the patterns identified in open coding in order to identify new patterns based on a multi-dimensional analysis comparing patterns against patterns (Creswell & Poth, 2017). We utilized selective coding to focus on specific patterns in order to identify explanatory themes to the study phenomena (Marshall & Rossman, 2010). This process is primarily focused on providing explanation and supporting evidence of the data in a way that can be meaningful to others (Straus & Corbin, 1990). The processes between open, axial, and selective coding is inherently ordinal, however, there are iterative elements to this exercise requiring a return to a prior step occurring over the course of multiple months as new patterns and themes were identified and explored.

When determining the success of any endeavor, it is critical that achievement be adequately defined. Many key performance indicators could be used for measuring organizational success including student satisfaction, staff satisfaction, and economic efficiency. Student achievement has also been suggested as an appropriate performance indicator for school

success (Hanushek, 1986). In the context of the CMI PD, one measure of student achievement is performance on state, end-of-level mathematical tests. For the purposes of this paper, schools and their respective principals are denoted as “highly successful” or “moderately successful” as measured by student performance on these tests as detailed below. In order to limit bias in the data collection and data analysis process, classification of a school’s relative “success” in the CMI PD did not occur until after the interview and open coding of the responses.

Data from the Utah mathematics Criterion-Reference Test (CRT) and from the Student Assessment of Growth and Excellence (SAGE) were analyzed for each school whose principal participated in the study in order to categorize school success. Standardized test scores were analyzed over 4-years within each school relative to the time period in which the particular school participated in the CMI PD. For example, if a school participated in the CMI PD from 2012 – 2014, the standardized mathematics test scores from 2012, 2013, 2014, and 2015 were considered. The highly successful group saw an average same school improvement in student performance over the 4-year period of roughly 12% (nearly 3% per year) with a standard deviation of 3.9%. In the moderately successful group, the average same school improvement over the same relative period was still positive, but less pronounced with a mean improvement of 2% with a 3.2% standard deviation (see Table 1).

A threshold of 75% was used to establish themes when considering the 16 principals as a group. When comparing themes between the highly successful and moderately successful groups during axial coding, patterns were established using a threshold of 50% in at least one of the groups and a 20% threshold in the difference between the two groups. This process yielded a number of interesting findings. Multiple responses on the same node by the same participant were noted but were not factored in during the establishment of thresholds.

Findings

All principals participating in this study came from elementary schools in which a measurable but varied level of student improvement in mathematics standardized tests was achieved during and following their school's participation in the CMI PD. There are a number of meaningful findings comparing the highly and moderately successful principals presented below, however, it is important to acknowledge that significant similarities exist across the majority of all participants interviewed. Since the CMI PD includes a training component for school leadership teams, and since, collectively, all of the participating principals experienced some level of success at their schools, it is not surprising that there are more commonalities between the two groups of principals than there are differences. We present these common findings where meaningful, however, given that our primary focus is to explore the disparate levels of success achieved within our sample schools and to determine the impact or influence of individual principals on the identified school performance changes, the commonalities were not focused on. General common themes are presented in Table 2. Common themes that fall within the scope of meaningful findings are presented in their respective sections in order to offer context to the patterns in which differences were noted between highly and moderately successful principals.

Principal Vision Statements and Indicators of Success

This study asked participants to state their individual vision of the CMI PD. Their responses were often expressions of a goal to be achieved or maintained. For example, all principals interviewed expressed a desire that participation in the CMI PD be successful in helping students at their schools develop a deeper content knowledge in mathematics. The majority of principals (75%) similarly expressed a desire for students to be taught how to shift away from the rote practices historically employed in mathematics learning (see Table 3).

[Insert Table 3 here]

Vision attributes. The general theme of deeper mathematical knowledge for students was observed in the data for both highly successful and moderately successful schools alike. One differentiating factor was found in analyzing the attributes of their respective visions of success. The majority of highly successful principals expressed vision statements that had elements of both brevity and clarity (67%) and were powerful in their simplicity (see Table 3). For example, highly successful principals defined the CMI PD success in simple statements such as "as a principal you want higher test scores" (Fred), and "I wanted to improve math scores" (Tina).

In contrast, moderately successful principals were more likely to provide more complex descriptions of what they wanted to accomplish as a result of their school's participation in the CMI PD (57%, see Table 3). These more descriptive indicators of success often started with a single goal (improve school culture (Amber), redesigning professional development (Edwin), bolster confidence in kids (Jack), etc.) and then shift into a long description adding multiple goals among multiple stakeholders in their response. For example, one principal's vision of success shifted from a desire to support increment-based instruction, student directed learning, teacher trust, improved instructor pedagogy, and finally ending on student and teacher mathematics confidence (Janice). While it was clear many of these beliefs and desires were deeply ingrained in the respondents, the reduced focus in the statements themselves lacked the power and simplicity that characterized their counterparts' more brief and singular visions.

Indicators of success. While both groups of principals clearly expressed a desire to improve performance, differences emerge within the individual vision statements related to what each principal viewed as indicators of success. As highlighted in Table 3, the most commonly defined evidence of success expressed by highly successful principals was the expectation to see

improvement in students' understanding as evidenced by performance on standardized mathematical tests as a result of their school's participation in the CMI PD (67%). These statements, focused on the student, capture an instructional leadership mindset characteristic of the principals at the most highly successful schools.

In contrast, moderately successful principals focused more heavily on the intermediate goal of improving teacher capacity and understanding by expressing their desire that teachers shift from rote mathematical practices (71%). During his interview, one participant highlighted this teacher-focused indicator of success when he stated:

> "[CMI PD] helps teachers break down their understanding of mathematics... They know algorithms and memorizing things, but they don't really have a deep understanding of it. They would work on those things, but [found it difficult to] transfer that to actually being a teacher. Their skills were limited and so they had holes in their learning. It was hard for them to then teach it any other way than just 'let's memorize the algorithm and work through this with you.' In providing this training for teachers, we were able to break down their processes and help them understand math at a deeper level" (Jack).

A shift in teachers' instructional practices is certainly an important step towards achieving success in student learning; however, where principals focus their attention when defining success in the CMI PD is a differentiator between those achieving high success versus their moderately successful counterparts. While highly successful principals engaged in some efforts to develop teachers as detailed below, that these principals focused on an indicator of success centered on student understanding is what sets them apart from principals at moderately successful schools (see Table 3).

Principal Interactions with and Expectations of Staff

Principals have an indirect impact on day-to-day student instruction through their direct interactions with teachers. All respondents expressed value in and provided examples of displaying commitment to their teachers and the program. Principals all expressed efforts to "walk-the-walk" with the CMI PD, a term used by many respondents and adopted in this study to describe efforts by each principal to display program commitment to their staff and participation as a fellow learner in the professional development. All principals made these efforts, though a close analysis revealed meaningful differences between the substance of the principal/teacher interactions.

Principal support. Moderately successful principals described their engagement with staff by focusing on supporting the teacher by building them up and reducing possible friction created as a result of their participation. For example, these principals engaged in efforts more protective of their teachers' time and feelings and were more likely to run interference for their staff (57%) in shielding them from interruptions including district demands and reducing alternative workloads. "I would take things off of their plate. If there were different district things came up, if it was a choice, or if it didn't have to be done, I didn't even bother the faculty with that" (Allison). Additional efforts to reduce potential friction for their staff included being available for questions or concerns (71%), and providing encouragement or cheerleading (57%) (see Table 4). One participant highlighted the need for engaging in positive messaging with his staff. "Be positive about it. Really a lot of what we do is selling it and hopefully we have some belief in what we're selling. But you have to be the cheerleader and be committed yourself to the process" (Richard). Moderately successful principals recognized they were asking their teachers

to stretch their abilities and operate outside of their comfort zone and were inclined to be protective of their time and outlined actions to buffer or shield them from discomfort.

[Insert Table 4 here]

In contrast, highly successful principals engaged in interactions that acknowledged that growth requires discomfort and outlined efforts to support teachers through the CMI PD expectations. These principals were more likely to mention their responsibility and role to create a safe environment for their staff that would allow them to expose their weaknesses in front of their peers through a trial and error process in order to promote improvement (67%, see Table 4). One principal attempted to ease the tension early on as he demonstrated teaching a third-grade lesson during a lesson study—ultimately failing miserably. This principal observed that a public display of ineptness by their instructional leader helped create an environment where it was okay to fail, if it was for the ultimate benefit of improving in the long run (Brad). Another principal similarly took upon himself to represent the weak link in the room "I made the decision early on that I would ask the questions that I [thought] others were [thinking] ... I feel like it [gave teachers] another reason to say 'Well, if he feels safe looking like an idiot, then maybe I can ask the question when I have [one], too'" (Richard).

The attempts to reduce environmental discomfort was not an effort to protect teachers from the difficulties associated with learning that comes through trial and error, rather, to support them through the inevitable vulnerability that a culture shift requires by creating an environment that encourages risk taking. During the CMI PD, teachers have numerous opportunities to confront their often-averse feelings about mathematics grounded in their feelings of inadequacy in the subject. This can be particularly discomforting and a risk for teachers as their weaknesses may be on full display for their peers to observe and potentially judge. The majority of principals

in the more successful group identified this potential concern and made concerted efforts to address it so that a safe environment conducive for risk taking and adult learning was fostered.

Participation versus teamwork expectations. In order to achieve their respective defined vision of success, the majority of principals talked about the need to both set expectations (88%) and hold staff accountable (63%). The question then is, to what standard were the staff held to? What were the expectations being communicated?

Moderately successful principals outlined their efforts to promote teamwork (86%) during their school's implementation of the CMI PD. They outlined the necessity of being a team player (100%) and looked to identify areas in which the principles of teamwork could be emphasized both within and without the CMI PD. For example, Amber highlighted the value teamwork brings when stating "Any time you can have schoolwide staff learning, it brings you all together. It gives you the same purpose. It gives common language, common experiences. That's how you help build your culture. And that's how your teachers grow together." Efforts were made to ensure that the CMI PD worked at promoting teachers functioning and working together as a team.

Highly successful principals, on the other hand, were more purposeful when talking about their expectations of teachers as highlighted in Table 4. They expressed efforts in holding the staff accountable to the decision they all made to participate in the CMI PD adoption (89%). Unlike their counterparts at moderately successful schools, the vast majority of principals at highly successful schools mentioned their efforts in working with the staff prior to beginning the CMI PD to create a shared responsibility in the initiative (78% versus 43%). These principals identified that before the CMI PD could be successful, stakeholders, particularly the teaching staff, had to share in the decision to participate and buy-in to the effort. It appears that the more

successful leaders did not make the decision to begin the CMI PD in an administrative vacuum even though they each could likely rely solely on their power as the institutional leader to force adoption.

One principal described his preparation efforts as follows, “I went and I had a faculty meeting and I asked them, ‘We have to be a hundred percent in this. There are no cop outs, whether you're teaching preschool or sixth grade. Were all in or we're out’” (Fred). Another described the importance of schoolwide preparation as her number one concern “because I knew this couldn’t be my initiative. It had to be *our* [emphasis added] initiative. I had to get buy-in from everybody. I went schoolwide” (Tina).

Principals in the highly successful group developed a shared decision in the CMI PD and enforced subsequent participation. In most elementary schools, teachers have the responsibility to teach all core subjects such as language arts, math, science and social studies within a specified grade level. Specialist teachers in technology or music often teach only their specialty across multiple grade levels. This study’s findings showed that once the collective decision was made, the majority (89%) of highly successful principals held each and every teacher to this standard by being fully engaged in the CMI PD regardless of their teaching responsibilities. Not only was this expectation clearly expressed to the teachers, but it was enforced through the actions the principals took before, and during the CMI PD implementation. Study participants in the highly successful group were more likely to share experiences in which they had to take an active role in enforcing this requirement for participation (78%). For example, one principal shared his experience with a particularly headstrong staff member who pushed back on the accountability efforts. “Why am I doing this? Why are you expecting teachers that are never going to have to do this be a part of this training” to which the principal replied “as a staff, we

are unified. So whatever one teacher does we're all going to do" (Aaron). Less extreme examples include instances where staff attempted to skip participation in individual CMI PD sessions resulting in principal interventions. Many of these examples could likely have justified an exception; however, the highly successful principal group were more likely to identify the value of full participation and provided concrete examples of enforcing this requirement regardless of the situation. They did not yield to individual requests for variances even if taking this stance meant uncomfortable conversation or resulted in tense relationships with teachers (see Table 4).

Discussion

The results from this study highlight the importance of a school leader. Our findings contribute to previous research in areas of leadership methodology, professional development, professional learning communities, teamwork, and vision. Due to the qualitative nature of this study, our findings are not generalizable and are limited to the schools and principals interviewed; however, they provide substantive understanding to current theory and offer insight into how the vision and actions of school principals are associated with bringing about desired change, and therefore, may be used to support broader application.

As presented in the findings, there are a number of common themes that exist within both the highly successful and moderately successful principal groups. These similarities offer insight into factors that created a baseline level of success as evidenced by the improved student performance the collective participating schools achieved. These findings are meaningful in a way that validates the positive effects of the CMI PD within the participating schools and provides opportunity for additional study. Additionally, current literature supports the conceptual model presented above and offers opportunity for future framework development particularly within the realm of learning-centered leadership theory (see Figure 2).

[Insert Figure 2 here]

Our findings provide four insights that principals can apply in order to influence student performance at their institutions. First, principals should frame their vision of success in terms of the ultimate end-goal desired, increasing student capacity. Second, in order to be most powerful, vision statements should be expressed with brevity and singularity of purpose. Third, principals should support principals by making efforts to reduce the negative effects of risk-taking within professional development. Finally, school leaders should engage staff early on in making the collective decision to participate in a program as substantial as the CMI PD and hold the staff accountable to this collective decision.

Instructional Leadership Focus for Indicators of Success

Our study reviewed the impact of principal beliefs, focus and activities on student achievement at schools participating in the CMI PD. The statements made by principals regarding the individual efforts in supporting the CMI PD were reviewed from the lenses of a transformational or instructional leadership focus. Those efforts focused on highlighting measurable student performance and advancing the student learner, indicate a certain deference toward instructional leadership models (Day et al., 2016). Efforts rooted in developing the teacher and the organization they operate in by focusing on a "process of leadership that raise organizational members' levels of commitment and shape organizational culture" are viewed as transformational in nature (Goldring et al., 2009, p. 5).

For the purposes of this study these leadership model definitions are simplified as student-focused (instructional) or teacher-focused (transformational) models. Our findings reveal that no principal is singular in their articulated adherence to a leadership theory and supports the conclusion that a blended implementation of both models, essentially fostering a learning-

centered leadership model, has a substantial effect at a school on the "quality of its pedagogy and the achievement of its students" (Marks & Printy, 2003, p. 370). Our efforts to identify whether study participants achieved an enhanced level of success in student performance due to a heavier emphasis on an instructional versus transformational model of leadership contributes to current research efforts to identify the appropriate blend of each in order to achieve an ideal learning-centered leadership model for increasing student achievement. This study does not attempt to resolve the dispute on the efficacy of the instructional versus transformational approach, but provides data and analysis suggesting that increasing the focus on instructional leadership methods when communicating indicators of success may result in measurably higher student performance. This is consistent with the suggestion by Robinson (2009) that a focus on instructional leadership outcomes has a greater effect on student performance than a focus on the intermediate goal of teacher improvement. It may be tempting to infer that reliance on transformational practices will result in reduced performance, however, there is nothing in the study data to suggest that highly successful principals did not engage in the same level of teacher-focused efforts as the moderately successful group, it was simply not highlighted during the interviews. Our analysis interprets the principal statements as evidence of differences in areas of focus among the participants.

It is unlikely that any of the principals interviewed would argue against the merits of activities geared towards teacher improvement as all engaged in meaningful efforts to positively impact their staff, however, "[i]f principals merely enable teachers to work together and do not help forge the final link to actual learning, the process will fail" (Fullan, 2018, p. 66). It was the end-result indicator of success that set the two principal groups apart. As Vescio, Ross, and Adams (2008) suggests, the relationship is ordinal: "improving student learning *by* [emphasis

added] improving teaching practice" (p. 82). It's not just the acknowledgement of student achievement, but a focus on the end-of-the-chain success metric that yielded greater results in this study. Student-focused statements such as "I wanted to improve math scores" (Tina) highlight the instructional leaning by the more successful principal group in defining success at the student understanding level as measured by standardized test performance.

In contrast, the moderately successful group expressed a transformational focus as they first identified a problem and expressed success in the CMI PD as teacher improvement. "For me the success was having everyone there and making sure [teachers] have a good learning experience whatever that was." (Edwin). Participants who indicated a student focused end-goal saw higher performance on student standardized mathematics assessments versus their peers that focused on the intermediate measure of success in teacher improvement. In short, greater student performance was achieved in those principals who espoused a preference towards instructional leadership strategies when defining success.

Brief and Clear Vision Statements

An additional insight related to vision, but not directly impacted by transformational or instructional leadership theory, involves an analysis of the content or attributes of the vision statements expressed by each principal. We discovered that the more successful principals made vision statements that were brief and singular in nature. Brevity refers to the vision's ability to be expressed efficiently. Kantabutra (2003) suggested the ideal length to be between 11 and 22 words, however, we did not employ such a strict hardline stance in determining whether a statement met this attribute's condition. Rather, a holistic approach was employed in determining whether a particular principal's vision statement was sufficiently brief, particularly when responding to questions regarding individual definitions of the CMI PD success. Unlike the

meandering vision statements expressed by moderately successful principals, those in the highly successful group made general vision statements that exemplified a spirit of brevity, likely indicating it was close to mind and could be expressed efficiently.

For a vision statement to have clarity it must be directed at "a prime goal it wants to achieve" (Kantabutra, 2005, p. 325). This attribute is closely related to brevity in that vision statements that are succinct are more likely to contain a singular goal. As the Russian proverb states, "if you chase two rabbits, you won't catch either one." Previous discussion has outlined the value of having this singular goal fixed on student understanding, however, regardless of the specific goal desired, a singular goal was identified as a defining attribute of highly successful principals.

Of note, Kantabutra and Avery (2007) presented seven vision attributes, of which we've only highlighted two that were particularly meaningful in distinguishing between highly successful and moderately successful principals. We contend that not all attributes need to be analyzed to justify this insight as meaningful as research has indicated that individually or a combination of vision attributes will magnify its effectiveness (Kantabutra & Avery, 2007).

Risk-Taking Environment

Principals who were concerned about protecting or shielding their teachers from difficult situations or pressures (i.e., principals with a teacher-focus) were less effective than those principals that worked to support their staff through creating a safe environment where mistakes became learning opportunities aimed at the ultimate goal of improving student achievement. When an environment conducive to risk-taking is developed, participants are more likely to expose and, as a result, allow their peers to provide guidance as they improve upon their weaknesses.

Supportive Accountability

We found that increased success was achieved by principals who enforced full participation by engaging in efforts to involve staff in the decision to participate in the CMI PD. "People support what they help to create" (DeFlaminis, Abdul-Jabbar, & Yoak, 2016, p. 35). If staff are involved in the process of program decision-making, they are more likely to engage and adopt. These findings support the research of Hulpia and Devos (2010) and Barnett and McCormick (2003) validating that there is a link between increased performance and shared decision making when implementing a significant program like the CMI PD. "Without this shared sense of creation and shared responsibility, excellence is unlikely" (Barnett & McCormick, 2003, p. 63).

Additionally, communicating expectations and providing the necessary support for individuals to achieve these expectations has been identified as a leadership criterion for excellence (Barnett & McCormick, 2003).

Future Research

The discussion presented above focuses primarily on the distinct differences in the level of student success influenced by the behavior and actions of principals. Additional research may be conducted to assess the impact of the broader leadership team at the district level and within the CMI PD program, including the off-site facilitator, on-site facilitator and their interactions with the principal. Research could also review the impact of the CMI PD outside of a leadership context to better assess the effect this particular professional development program has on student achievement generally.

Additionally, while principal responses in this study were expressed in terms of an organization vision, only principal responses were captured. Future research may be conducted

with the responses provided by district leaders, school staff, and teacher in order to identify whether a principal's vision was adopted by the organization.

Limitations

Qualitative research does not typically allow causal inferences from its findings. This study involved an analysis of 16 principals whose responses may not reflect those shared by principals generally. We recommend additional quantitative research be conducted to substantiate generalizability in other situations as well as to identify possibly causality and correlation between the proposed constructs.

The 16 principals interviewed in this study have different backgrounds and were leaders at schools representing a variety of demographic variables including principal sex, age, years in administration, time at the school that implemented CMI, etc. School size, student populations and socioeconomic status were also not accounted for. These limitations provide opportunity for future research.

Concerns regarding the potential memory biases based on the individual differences in the time since the CMI PD implementation was identified in the methods section above. All efforts were made in the organization, structure, and content of the questions in order to elicit comparable responses and limit these memory biases.

Conclusion

This research explored how the vision, beliefs and reported efforts made by principals in the implementation of the CMI PD program effected student achievement. Our findings suggest that the most successful principals engaged in efforts to improve the quality of their teachers but with the ultimate goal of enhancing student learning as their primary indicator of success. Additionally, while the actions taken by principals are a meaningful influencer on student

performance, we posit that it's not merely these efforts that impact student achievement. Greater success was correlated with those principals who could succinctly define and express vision statements with a singular efficiency. Additionally, principals who support their teachers by not buffering them from discomfort, but rather developing an environment where risk-taking is encouraged are able to enhance the effectiveness of professional development. Finally, principals who made efforts to support their staff in professional development through shared decision making and supportive accountability saw greater impacts on student achievement versus their more protective teamwork-focused counterparts.

Educators should continue to research the effects of principals in the implementation of professional development. Increased understanding of the effect that a school leader, such as the principal, has on student achievement will likely result in changed behavior and increased student performance.

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Tables

Table 1

Principal and School Demographics

Principal Sex	Male: 7	Female: 9
Highly Successful	Male: 4	Female: 5
Moderately Successful	Male: 3	Female: 4
Principal Age (when interviewed)	Average: 49	Range: 39 – 61
Highly Successful	Average: 51	Range: 42 – 61
Moderately Successful	Average: 47	Range: 39 – 58
School Title 1 Status	8 of 16 (50%)	
Highly Successful	4 of 9 (44%)	
Moderately Successful	4 of 7 (57%)	
School Enrollment	Average: 626	Range: 418 – 1014
Highly Successful	Average: 648	Range: 472 – 828
Moderately Successful	Average: 598	Range: 418 – 1014
School 4-Year Post CMI-PD Gain in Math Performance	Average: 8%	Range: -3% - 16%
Highly Successful	Average: 12% σ: 3.9%	Range: 5% - 16%
Moderately Successful	Average: 2% σ: 3.2%	Range: -3% - 5%

The 2-sample t-test was 5.56 with a p-value < 0.0001
The 95% CI between the highly and moderately successful groups was 5.5% to 13.2%

Table 2

Participation in CMI

CMI Participation Years	Highly Successful Principals	Moderately Successful Principals
2004 – 2006	Jane	
2006 – 2008	Grace	Edwin
2007 – 2009	Aubrey	
2010 – 2012	Fred	John
2012 – 2014	Aaron, Richard	Jack, Dorris
2013 – 2015	Brad	Allison
2014 – 2016	Kassie	Amber
2015 – 2017	Tina	Janice

Table 3

Common Program Efforts of Principals

Theme	Highly Successful	Moderately Successful	Representative Responses
Show Commitment to the CMI PD	100%	100%	*"When I came as a principal, I knew what [the CMI PD] could do and was committed to finding a way to get it done." (Aaron) [Highly Successful]* *"I was just as much of a participant with them as they were so they could see that it meant something to me because I wanted everybody to be participating. I made sure I was at everything." (Aubrey) [Highly Successful]* *"[The staff] knew that I was dedicated to it that I wanted it to succeed and that I was doing everything I could to make sure that happens." (Doris) [Moderately Successful]*
Participate in the CMI PD Lesson Study	100%	100%	*"If the teachers were in professional development, I was in professional development. I was doing what they were doing. They saw me interacting and modeling just like they would." (Jane) [Highly Successful]* *"Again it wasn't just you guys do lesson studies. I was involved with all of them." (Richard) [Highly Successful]* *"I was very involved in the PD during the time that I was there. I didn't just sit in the back and let them go with it… I was very much engaged with the presentation to my faculty... because I wanted them to understand how this training fits into our overall school improvement plan." (John) [Moderately Successful]*
Participate as an Instructor in the CMI PD	89%	86%	*"I did not sit on this side and just participate. I make sure that I had skin in the game... I presented every week." (Fred) [Highly Successful]* *"In the second year I took on the role of one of the facilitators. I would take a part." (Janice) [Moderately Successful]* *"I decided to become one of the presenters" (Richard) [Highly Successful]*

Participate as an Observer in the CMI PD	89%	86%	*"We would go in and observe the classroom with all the other teachers." (Aaron) [Highly Successful]* *"I just set up a schedule where a grade level would just sign up for the month that they wanted me to come observe their lesson study" (Kassie) [Highly Successful]* *"It was fun going into math lessons as an administrator when I would just go and observe" (Richard) [Highly Successful]*
Participate in the CMI PD Implementation Training	78%	71%	*"We had our offsite trainings that we would do with Sue in the summer." (Aaron) [Highly Successful]* *"Myself and my two trainers went to some training in the summer on how to present it and how to teach our teachers." (Allison) [Moderately Successful]* *"I attended the trainings the summer before with three other people." (Jack) [Moderately Successful]*

Table 4

Principal Vision Statements

Theme	Highly Successful	Moderately Successful	Representative Responses
Students Develop Deep Content Knowledge	100%	100%	*"[My hope is that students] would understand math at a deeper and better level." (Aubrey) [Highly Successful]* *"I hoped that it would improve mathematical understanding for students, that instead of just manipulating numbers within an algorithm where they didn't understand the math behind the algorithm, that they would have an understanding of how the algorithm worked and what was actually happening when they were manipulating the numbers... hence greater understanding all along the way." (Jane) [Highly Successful]* *"[My goal is that] students gain conceptual knowledge and not just procedural knowledge." (Doris) [Moderately Successful]* *"I really hoped that the kids would be able to truly understand math, instead of just do math... and not be afraid math and be able to think mathematically and be able to approach problems with the "hey we can solve this... There's different ways we can do this... Different tools we can use in different ways to approach it." As opposed to just memorizing" (Edwin) [Moderately Successful]*
Students Shift from Rote Practices	78%	71%	"*I wanted more student opportunities to think and grow for themselves and not to be just doing worksheets. I wanted them to get the concepts, representations and procedures.*" *(Tina) [Highly Successful]* "*Our mindset has been that if we teach them the algorithm and give them enough independent practice that will be ready for whatever they faced. And what we found, historically, like many other schools, is that we're probably creating a huge challenge for kids... they are getting lost in just trying to formulate what truly was being asked of them.*" *(Grace) [Highly Successful]* "*So it's not particles of knowledge out there that they've got to memorize and keep track of... but it comes in the context of high level tasks and orders that allow them to connect their thinking.*" *(Aaron) [Highly Successful]*

Brief and Singular	67%	29%	When asked for their vision of the CMI PD: *"The teachers were instructing more so the students gained conceptual knowledge and not just procedural knowledge." (Doris) [Moderately Successful]* *"I wanted CMI to be able to create a common language; To create something where teachers could take our whole collaborations to another level." (Fred) [Highly Successful]* *"I hoped that it would improve mathematical understanding for students." (Jane) [Highly Successful]*
Complex and Multifaceted	33%	57%	*"I believe very strongly in the increment-based instruction. I believe that students come with knowledge and our job is more about pulling that knowledge out and helping them make connections between their own ideas and helping them see the big picture in math. But I wanted more student involvement in their mathematics learning process, so my goal with CMI was to be for teachers to trust students and allow students to be more involved in their own learning of mathematics. Another goal would be for teachers to become more of a questioner than a demonstrator. I think through the right questions teachers can help students own their learning and make their own connections and really be competent mathematicians. I don't want students to leave [our school] not feeling confident that at some level of math, they can do it. They can problem solve. They can persevere. I want them to be confident. I want my teachers to be confident in their ability to help students do that. So overall I wanted to see a shift in teaching through more questions, through more exploring. After the CMI I wanted them to do it even more. I wanted to really walk in a classroom and see those students owning their learning so they don't grow up to be adults that say 'I'm not good at math.' I just don't like that. I want people to feel as confident in math as they do as a reader." (Janice) [Moderately Successful]* *"My hope really was to help kids feel like they could be successful at doing anything; that they could become problem solvers. I mean that was the biggest thing. I think a lot of kids really struggle with math and feel like I'm not a math person almost like you have to be a certain type of person to get math, but instead of wanting that to be the way that they viewed math, we want it to be something where it's fun, it's problem solving. If you get it wrong, it's OK. You don't have to feel like that's the end of the world. You actually feel like 'oh we tried and tested some things, it didn't work, let's try a different angle.' But it really generates problem solving skills. And kids need that for their whole lives. So*

			this was bigger than just math. It was also a great support for math because as a title one school we wanted to be continually making improvement in our instruction" (Jack) [Moderately Successful]
Success as Student Improvement in Test Performance	67%	29%	When asked what they hoped to accomplish by participating in the CMI PD: *"I wanted to improve math scores." (Tina) [Highly Successful]* *"Initially it was just to improve math scores." (Richard) [Highly Successful]* *"Better academic outcomes. To see scores raised." (Doris) [Moderately Successful]*
Success as Teacher Shift from Rote Practices	11%	71%	When asked what they hoped to accomplish by participating in the CMI PD: *"I think historically we had focused so much on the drill and kill method of teaching. Our mindset has been that if we teach them the algorithm and give them enough independent practice that will be ready for whatever they faced." (John) [Moderately Successful]* *"I felt like [the CMI PD] is great for several reasons. It helps teachers breakdown their understanding of mathematics. A lot of times teachers come from a place of having sat and performed problems like algorithms and memorizing things but they don't really have a deep understanding of it… Their skills were limited and they had holes in their learning. It was hard for them to then teach it any other way then 'let's memorize the algorithm.' (Jack) [Moderately Successful]* *"I love seeing kids have choice and stand up on their own, going and getting a tool they know will be helpful for them without the teacher handing out the tools and saying everyone use these." (Janice) [Moderately Successful]*

Table 5

Principal Interactions with Staff

Theme	Highly Successful	Moderately Successful	Representative Responses
Walk-The-Walk	100%	100%	*"I would never ask them to do anything that I didn't do myself or believe in." (Amber) [Moderately Successful]* *"That's kind of my philosophy; if teachers are doing it, then I'm doing it. If they're in, I'm in. I won't ask them to do something that I won't do 100% myself." (Tina) [Highly Successful]* *"You've got to be able to walk the walk and talk the talk. You can't just sit there and not participate and not be a part of the actual process of professional development." (Jack) [Moderately Successful]*
Create an Environment Safe for Trial and Error	67%	29%	*"I made the decision early on that I would ask the questions that I think others were asking ... I feel like it is another reason to say 'well, if he feels safe looking like an idiot then maybe I can ask the question when I have it too.'"(Richard) [Highly Successful]* *"People have to work through that vulnerability and be willing to then say, 'OK I'll take chances, I feel safe enough now in this environment.' And going back to what I said before, [teachers] learn it there in the professional development then they have to go translate that to their students. Saying, 'how do I create this environment where it's OK for you to make mistakes it's OK for you to be wrong?' We've got to be safe enough to be able to say 'explore'. You know you've got to take chances to do this." (Jack) [Moderately Successful]* *"We created an environment that was safe." (Tina) [Highly Successful]*
Run Interference for Staff	22%	57%	*"They knew that I was trying to protect their time" (Janice) [Moderately Successful]* *"During those two years, I really protected my staff from other in-services…" (Fred) [Highly Successful]*

			"I would take things off of their plate. If there were different district things came up, if it was a choice, or if it didn't have to be done, I didn't even bother the faculty with that." (Allison) [Moderately Successful]
Be Available for Questions or Concerns	33%	71%	*"I allowed them to have a voice and shared what was working and what wasn't working and, depending on what I found out, I'd go and represent that." (Jane) [Highly Successful]* *"I really had to build levels of trust with the teachers so they even feel comfortable to come to me with things that they didn't want to do typically." (Jack) [Moderately Successful]* *"[I was] available for them to ask questions of." (Amber) [Moderately Successful]*
Be a Cheerleader	33%	57%	*"So it's a lot of pumping them up that they can actually do it." (Amber) [Moderately Successful]* *"I remained positive. I mean it was hard. To ask teachers to take three and a half hours of sitting time and then plus tons of work from their families each week. So just getting up every morning, being a cheerleader was something that had to be done." (Edwin) [Moderately Successful]* *"Be positive about it. Really a lot of what we do is selling it and hopefully we have some belief in what we're selling. But you have to be the cheerleader and be committed yourself to the process." (Richard) [Highly Successful]*
Set Expectations (when discussing the role of the principal)[1]	78%	100%	*"Ultimately my goal as the principal was to set the vision, set the norms." (Aaron) [Highly Successful]* *"I think it's important to set an expectation." (Brad) [Highly Successful]* *"Set a clear expectation and then provide a way to get there." (Tina) [Highly Successful]*

[1] Even though there is a delta of 22% between highly successful and moderately successful principals, the large majority of principals that provided representative responses suggests a meaningful theme and is presented as a commonality across both groups (especially when taking into account instances in which principals described instances of setting expectations (see footnote 2)).

Set Expectations (when discussing principal actions)[2]	56%	29%	*"I insisted that we all were doing it, and there were no exceptions. And that gets around fast. You don't have to tell everybody that... that gets around the grape vine pretty fast, and I think they realized that I was serious, and that we all had to do this." (Grace) [Highly Successful]* *"I came in that first year and I played hardball. I just let them know we are not doing this. These kids deserve more and so do you." (Tina) [Highly Successful]*
Expect Full Staff Participation	89%	29%	*"It was part of the expectation that if I'm there, everyone was there." (Aaron) [Highly Successful]* *"I went and I had a faculty meeting and I asked them... we have to be a hundred percent in this. There is no cop outs, whether you're teaching preschool or sixth grade. Were all in or we're out. And that's basically the discussion we had." (Fred) [Highly Successful]* *"And I made it... I insisted that we all were doing it, and there were no exceptions." (Grace) [Highly Successful]*
Communicate Requirement for Participation	89%	29%	*"[A teacher asked],'Why am I doing this? Why are you expecting teachers that are never going to have to do this be a part of this training?' And I said, 'as the staff, we are unified. Whatever one teacher does we're all going to do.'" (Aaron) [Highly Successful]* *"I insisted that, yes we're going to do this, we're all going to do it together." (Grace) [Highly Successful]* *"What I told them is that, this was something that we were doing together. It was something that they still had a voice on, but when we were choosing to do it we were all in together. We were going to do this together. And that was the commitment that they made with me." (Jane) [Highly Successful]*
Respond to Teacher Pushback	78%	57%	*"We do have a couple of teachers that I've had to go have a conversation with and say, 'look I know you have a way you like to teach math, but you're part of a professional learning community and they're creating things and they're doing some stuff and I need you to get on board with this.'" (Brad) [Highly Successful]*

[2] While this theme doesn't meet the thresholds identified, it is included here due to its relationship with footnote #1.

			"If tough conversations had to happen, that was my role" (Edwin) [Moderately Successful]
Shared Decision Making	78%	43%	*"But really the number one thing that I did was getting stakeholders on board because I this couldn't be my initiative. It had to be our initiative. If it was just me, I could have lost people, but I had to get buy in from everybody." (Tina) [Highly Successful]* *"We just showed [the teachers] where things were at and just kind of showed the situation and kind of faced those brutal facts that we are not helping these kids learn as well as we can and as well as we should. So that was the first thing we did. And then once that humility was there--the slap in the face--then it was 'all right, so what are we going to do about it?'" (Edwin) [Moderately Successful]* *"I went and I had a faculty meeting and I asked them. We have to be a hundred percent in this. There is no cop outs, whether you're teaching preschool or sixth grade. Were all in or we're out." (Fred) [Highly Successful]*
Efforts to Prepare Staff or School	67%	29%	*"So for a year I had already been talking about math instruction and questioning... I talked a lot about questioning my first year as a principal, before I even said the term CMI to them." (Janice) [Moderately Successful]* *"I had prepped my leadership team ahead of time sharing the positive feedback from other schools and I got them on board first." (Richard) [Highly Successful]*
Promote Teamwork	22%	86%	*"It was a team. Like I said the vision wasn't just my vision. It was my facilitators, my title one coordinators, my coaches as well as so many teachers that bought into it that it wasn't just me." (Aaron) [Highly Successful]* *"Any time you can have schoolwide staff learning, it brings you all together, it gives you the same purpose. It gives common language, common experiences. That's how you help build your culture. And that's how your teachers grow together." (Amber) [Moderately Successful]* *"I just got pretty excited about how it brought teams together of teachers and the learning together." (Edwin) [Moderately Successful]*
Team Player	78%	100%	*"You have to be able to recognize the talents and abilities in others to pull together a team to pull it off. And then when you don't know, ask for help." (Jane) [Highly Successful]*

	"Everybody needs to be working as a team because part of the training is that you're doing teamwork with the lesson study." (Kassie) [Highly Successful] *"I got the right people on the bus." (Edwin) [Moderately Successful]*

Figures

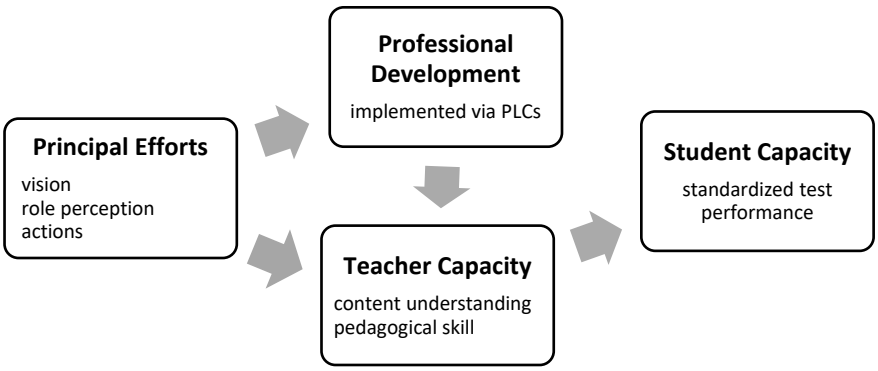

Figure 1. Principal's influence on the CMI PD success.

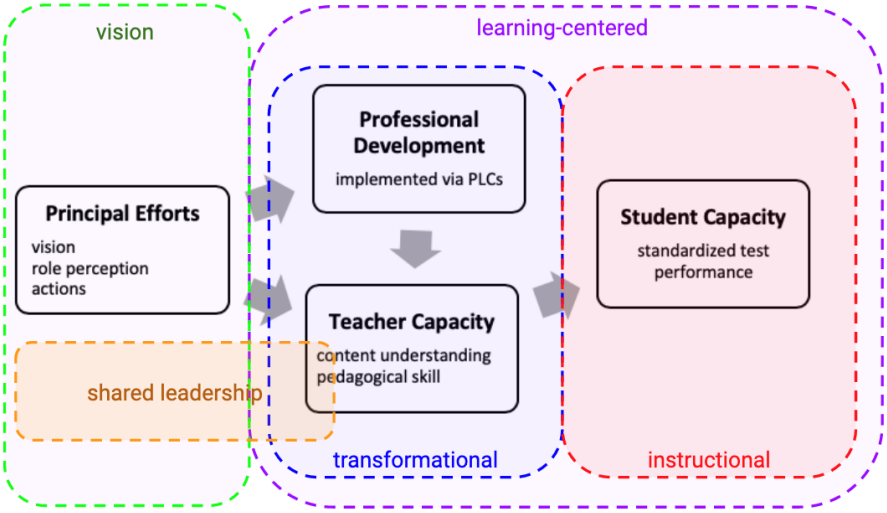

Figure 2. Current literature and the conceptual framework

APPENDIX A

Review of Literature

Student improvement is arguably the universally accepted purpose of the formal education system. Not surprisingly, student improvement is, in part, the result of the quality of the education provided (Darling-Hammond, 1999; Harris & Sass, 2011; Kukla-Acevedo, 2009). Since 2002 the majority of US schools have been measured by the expectations in the No Child Left Behind (NCLB) legislation as a litmus test for school performance. This legislation established a national standard by which schools are evaluated. Even before the inception of NCLB, the change often desired by most educational stakeholders was measured by student achievement (Hanushek, 1986; Rutter, Maughan, Mortimore, Ouston, & Smith, 1979). With NCLB standards, an emphasis and standard accountability is placed on principals with more formal expectations to achieve improvement on student educational outcomes (Robinson, 2010). While this legislation renewed an emphasis on standardized student performance, the causal link between the school environment, including its school leaders, and effective schools pre-dates its introduction (Brookover & Lezotte, 1979; Coleman, 1968). Four decades ago, Edmonds (1979, p. 22) identified the relationship between a successful school and an effective principal "without which the disparate elements of good schooling can neither be brought or kept together."

This literature review does not focus on whether a principal effect on school performance exists as nearly all historical and current research supports this proposition. This review assumes principals have an impact on the schools they lead. It also assumes that principals have always, pre- and post-NCLB, had expectations of improving student performance at their schools. This review provides context as to how those expectations are manifested. It responds to who principals impact and how that impact is operationalized. It begins with a review on the various

roles that principals are asked to fill and the effects these roles have on teacher and student stakeholders. A historical analysis of principal leadership theory is provided with evidence suggesting a trend towards learning-centered leadership models encapsulating elements of both transformational and instructional leadership theory. Additional research analysis is provided as context to specific study findings including professional development, vision, and support theory.

Principal Roles

In order to be effective, principals must be the quintessential generalist, requiring them to adopt a myriad of roles at their schools: the instructional leader, financial analyst, counselor, curriculum expert, community builder, and the educational visionary for the organization (Darling-Hammond, LaPointe, Meyerson, Orr, & Cohen, 2007; Fullan, 2010). Despite the many expectations placed on principals, scholarly acknowledgement of their effect has not always been highlighted in literature. In fact, research has just recently started to "give overdue recognition to the critical role and mounting demands on school principals" (Davis, Darling-Hammond, LaPointe, & Meyerson, 2005, p. 3) recognizing that "the role of principal has swelled to include a staggering array of professional tasks and competencies" (Davis et al., 2005, p. 3). Principal efforts have been found to impact both teachers and students as explored below.

One of the many indicators of an effective principal is related directly to the teachers that work at the schools in which they lead. "[P]rincipal leadership is positively associated with teacher satisfaction, teacher morale, commitment to the workplace, and teacher retention." (Grissom & Harrington, 2010, p. 584). The most successful leaders are able to influence retention in good instructors while facilitating higher turnover for less effective staff members (Beteille, Kalogrides, & Loeb, 2009).

The many roles principals fill are all for naught if their efforts don't affect the ultimate goal of improving the educational experience for their students. In their meta-analysis, Marzano, Waters, and McNulty (2001) concluded that "principals can have a profound effect on the achievement of students in their schools" (p. 38). It is suggested that this principal effect is "measurable, though indirect" on student achievement (Hallinger & Heck, 1996, 1998). Additional studies have found that even though principals are not in the classroom teaching students directly, successful principals have the capacity to drive school change and ultimately influence student performance (Bryk, Sebring, Allensworth, Easton, & Luppescu, 2010; Louis et al., 2010; Marzano et al., 2001).

In their study, Hallinger and Heck (1996) reviewed 40 preceding studies using the framework presented by Pitner (1988) in order to analyze the relationship between principal leadership and student performance. A model outlining this conceptual framework is presented below as Figure 1.

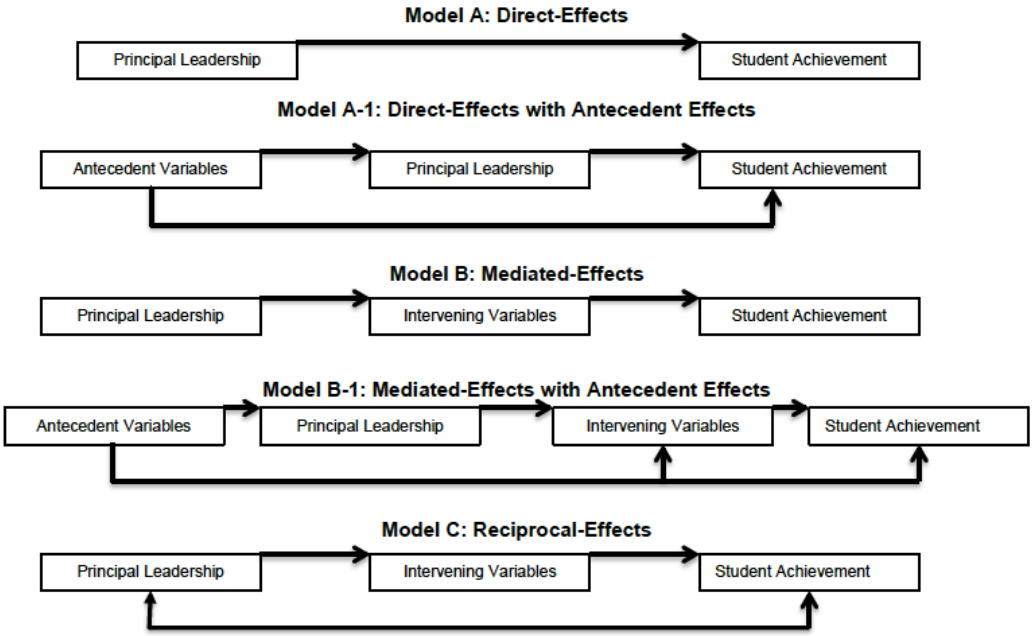

Figure 1. Principal leadership and student achievement.

In Model A, the researchers analyze the direct effect principals have on student achievement, finding that minimal to no effect on student achievement occurs directly even with antecedent variables such as principal values and beliefs or knowledge and experience (Hallinger & Heck, 1996). A similar study exploring the potential direct effect concluded that "there is no evidence for a direct effect of educational leadership on student achievement in secondary schools" (Witziers, Bosker, & Krüger, 2003, p. 415). Criticism of this model stems primarily from the observation that its simplicity ignores the intervening variables that exist within the school organization. Principals are not traditionally expected to be in the classrooms directly teaching students. Their impact is better classified as an indirect effect. Models B and B1 introduce these mediating constructs theorizing that principal leadership affects some intervening variable (e.g., teachers) which then impacts student performance directly. Their research provided evidence indicating that there is a relationship between school outcomes and principal efforts, a relationship mediated by other factors within the school organization (Hallinger & Heck, 1996). Additional research validates this model, finding critical intermediate factors, including teachers, as mediating variables (Bell, Bolam, & Cubillo, 2003; Cotton, 2003).

In their review, Hallinger and Heck (1996) did not find studies that met the Model C organization but identified future research opportunities in studying the potential reciprocal nature between student achievement and principal leadership. This study similarly does not explore the potential reciprocal relationship between these constructs but acknowledges the potential value of future research in this area. It is within models B and B1 that this review relies on for its analysis of the relationships between principal, teacher, and student.

Though indirect, principal impact is meaningful within the realm of educational factors. Leadership has been identified as second only to classroom instruction as a primary influencer on

student learning (Leithwood & Jantzi, 2008). The impact of this effect has been attempted to be measured by Leithwood, Louis, Anderson, and Wahlstrom (2004) who determined that school leadership accounts for roughly twenty-five percent of all school effects on student learning. While other scholars' focus may vary, most generally agree that a principal effect exists. "[T]here is not a single documented case of a school successfully turning around its pupil achievement trajectory in the absence of talented leadership" (Leithwood, Harris, & Hopkins, 2008, p. 29). Conversely, as influential as principals can be on positive student performance, they can also have a "marginal, or worse, negative impact on achievement" when a principal is ineffective (Waters, Marzano, & McNulty, 2003, p. 5).

Instructional and Transformational Leadership

Research focused on the effect principal leadership has on student outcomes has been conducted for decades with multiple leadership theories and suggested practices emerging, including "instructional" and "transformational" leadership models. Early instructional leadership theory describes a student-focused method, with an emphasis on the learner, by engaging in efforts to promote better measurable outcomes for students through curriculum planning as well as pedagogical improvement and evaluation (Day, Gu, & Sammons, 2016; Hallinger, 2003; Marks & Printy, 2003). Transformational leadership originated in research proposed in the 1990s and is rooted in an organization-focus with an emphasis on the "process of leadership that raise organizational members' levels of commitment, and shape organizational culture" (Goldring, Porter, Murphy, Elliott, & Cravens, 2009, p. 5). While instructional leadership originated in the educational setting, transformational leadership theory has broader application across several types of organizations including schools, military, and business (Bass & Riggio, 2006). This study looks at each leadership model and generally categorizes the

instructional model as “student-focused” and the transformational model as “teacher-focused.” Therefore, the differences between these two models is largely a first-order question, whether the primary focus is centered on students directly (instructional) or on teachers as mediating variables (transformational).

An amalgamation of these two philosophies has emerged in recent years as researchers explore where administrative focus should exist in order to enhance a principal’s impact on student achievement (DuFour, 2002; Goldring et al., 2009; Hallinger, 2011; Hallinger & Heck, 2010; Knapp, Copland, Honig, Plecki, & Portin, 2010; Knapp, Copland, & Talbert, 2003; Marks & Printy, 2003; Murphy, Elliott, Goldring, & Porter, 2006; Robinson, 2010). There is current debate on the appropriate blend of instructional versus transformational leadership efforts in order to maximize student performance.

Instructional leadership focus. The quantitative meta-analysis of Robinson (2009) suggests that a greater focus should be placed on instructional leadership, concluding that its effect on student outcomes is a multiple of three or four times greater than that of transformational leadership. Their prior research found that “the closer educational leaders get to the core business of teaching and learning, the more likely they are to have a positive impact on students’ outcomes” (Robinson, Lloyd, & Rowe, 2008, p. 664). These researchers also suggest that transformational leadership is embedded in the construct of instructional leadership in that a focus on the latter would inherently include elements of the former.

Fullan (2006) posits that the managerial activities often associated with transformational leadership—the “maintenance activities” (p. 10)—distract principals from the more beneficial instructional efforts that the school leader should focus on. This call to focus on instructional efforts is not new. Research by Brookover and Lezotte (1979) found that “[i]n the improving

school, the principal is more likely to be an instructional leader, is more likely to be assertive in his or her instructional leadership role …" (p.5). More recent studies have identified that principals who implement instructional leadership behaviors have a more positive impact on student achievement than those who express other leadership styles (Boyce & Bowers, 2018; Hallinger & Heck, 1996; Heck & Hallinger, 2009; Marks & Louis, 1999; Marks & Printy, 2003; Robinson et al., 2008; Seashore Louis, Dretzke, & Wahlstrom, 2010).

Transformational leadership focus. Other researchers argue that the managerial organization better supports positive learning outcomes through student achievement than certain expressions of instructional leadership (Horng & Loeb, 2010). It is in these activities that principals often spend their efforts. One study in particular tracked principal time by type of responsibility, finding that materially more time was spent on administrative tasks (what may be termed transformational leadership activities) versus instructional leadership efforts (Horng, Klasik, & Loeb, 2010). Additional research suggests this focus may be appropriate, finding that organization management efforts "appear very important, even more important than those associated directly with instruction" in the context of school success (Horng et al., 2010, p. 521). In a separate study, these researchers identify the instructional leadership model as too narrowly defined and instead promote an emphasis towards a managerial focus as they "consistently find that schools demonstrating growth in student achievement are more likely to have principals who are strong organizational managers" (Horng & Loeb, 2010, p. 67).

Transformational leadership has been identified as an effective catalyst for culture and environment change for those schools undertaking a significant reform effort (Leithwood & Jantzi, 2006) and for those seeking improvement with teacher and staff relations (Bogler, 2005; Griffith, 2004). While the link between teacher commitment and self-efficacy and

transformational leadership has been validated, many of these same researchers identify a relatively weak relationship between transformational leadership and student academic performance (Leithwood & Jantzi, 2006; Ross & Gray, 2006).

A blended learning-centered leadership focus. Despite research arguing for a singular emphasis on either approach, many, including Day et al. (2016), suggest neither leadership styles should be over-emphasized, finding that the "overrigid distinction between transformational leadership and instructional leadership" (p. 225) is not supported, and current study findings suggest no empirical evidence exists that instructional leadership has a more significant effect on students than transformational leadership (Day, 2011). Many researchers now propose a learning-centered leadership model encompassing elements of both instructional and transformational theories (DuFour, 2002; Goldring et al., 2009; Liu, Hallinger, & Feng, 2016; Murphy et al., 2006; Robinson, 2010). Hallinger (2011) observed that "[t]he fervor of debates over which model offers the greatest leverage for understanding how school leaders contribute to learning has reduced in recent years" finding that the new learning-centered leadership model "has come to subsume features of instructional leadership, transformational leadership, and shared leadership" (p. 126). Support for this blended approach concludes that "when transformational *and* [emphasis added] shared instructional leadership coexist in an integrated form of leadership, the influence on school performance, measured by the quality of its pedagogy and the achievement of its students, is substantial" (Marks & Printy, 2003, p. 370). Instead of using the term learning-centered leadership, these researchers described this blending of methods as an integrated leadership model (Marks & Printy, 2003). For the purposes of this research, we refer to all blended models of instructional and transformational leadership as learning-centered

leadership, and do not attempt to identify whether the differences in the terminology is meaningful.

The research presented by Darling-Hammond et al. (2007) identifies that the "daunting array of roles" expected of principals requires a blended approach as school leaders are expected to be "educational visionaries and change agents, instructional leaders, curriculum and assessment experts, budget analysts, facility managers, special program administrators and community builders" (p. 1). This thinking ties to research identifying the codependent relationship between student performance and school variables, necessitating this blended learning-centered practice (Goldring et al., 2009). A singular approach is insufficient, DiPaola and Tschannen-Moran (2003) argues, finding that principals "need help with *both* [emphasis added] the instructional and managerial aspects of their job" (p. 60). Collins and Porras highlight the danger of the adoption of a single strategy or approach labeling it the "Tyranny of the OR" and encourage leaders to instead, embrace the "Genius of the AND" (Collins & Porras, 2002). Research focused on education similarly found "that most school variables, considered separately, have at most small effects on learning" with exponential results occurring "when individual variables combine to reach critical mass" (Harvey & Holland, 2012, p. 3). By nature, this combined approach acknowledges the deficiencies of a principal acting alone and recognizes both the direct and indirect value a school leader brings. As stated by Lambert (2002) and agreed by Hallinger (2003), "The days of the lone instructional leader are over. We no longer believe that one administrator can serve as the instructional leader for the entire school without the substantial participation of other educators" (p. 37). Hallinger (2003) calls this a "mutual influence process" in which the principal influences those who have a more direct exposure to students versus a "one-way process" (p. 346).

In summary, two main thoughts emerge from current research regarding instructional and transformational leadership. First, researchers generally acknowledge the benefits of a blended learning-centered leadership approach but there is no consensus of how or whether this blend should be weighted toward instructional or transformational efforts. Many are beginning to view transformational leadership as a subset of instructional leadership in the new learning-centered leadership theories. Secondly, effective learning-centered leadership has an important but indirect effect on student performance. Leaders affect individuals and the organization, who in turn, directly affect students.

The purpose of this study was not to identify a precise mix of leadership styles to maximize student performance, but rather to add to the current literature suggesting that a blended learning-centered leadership approach may be an effective mechanism for principals to maximize their impact on student achievement. In certain cases, our study found that principals who expressed a heavier weighting towards instructional leadership had a more positive effect on student performance.

Professional Learning Communities

Most current professional development relies on the structure of professional learning communities (PLCs) in order to train and educate school staff. The PLC construct has existed for decades with the modern version emerging within the last 15 years. Many believe the PLC is the most effective way to improve schools by supporting teachers in their efforts to influence student performance (Blankstein, 2004; DuFour & Eaker, 2009b; Louis & Kruse, 1995; Louis & Marks, 1998). The PLC structure has been described as “the surest way to help teachers to help all students” (Hord, 1997, p. 23) and “the best, least expensive, most professional rewarding way to improve schools” (DuFour & Eaker, 2009a, p. 128). A PLC’s general purpose is to develop

attitudes, values, and assumptions to improve all aspects of the school organization (Schein, 1990). But its primary purpose is to improve student learning (McLaughlin & Talbert, 2006). There is strong suggestion that the PLC structure is able to influence student success by impacting teacher performance; however, few studies to date have provided clear evidence of this causal link.

Transformational Leadership Aspects of PLCs. Principal support for PLC's manifests in both transformational and instructional leadership efforts. For example, Newman (1996) identifies a number of teacher-focused activities considered essential characteristics of PLCs including collaboration, shared values and norms, reflective dialogue, and de-privatizing practices. This collaboration focus is a principle theme in effective PLCs (Little, 1990; Saunders, Goldenberg, & Gallimore, 2009; Supovitz, 2002).

Instructional leadership aspects of PLCs. Additionally, instructional leadership is highlighted as an essential characteristic as (Newman, 1996) further describes the need for effective PLCs to have a consistent and clear focus on student learning. This blended, learning-centered methodology was later validated in a multi-site PLC study in which the essential characteristics were synthesized with the general definition of a PLC emerging as a construct with "the capacity to promote and sustain the learning of all professionals in the school community with the collective purpose of enhancing student learning" (Bolam et al., 2005, p. iii).

Blended learning-centered leadership aspects of PLCs. Principal efforts in successful PLCs manifest, almost universally, as a learning-centered leadership process. Improvement of both teacher and student are highlighted as essential components of effective PLCs with these two focuses not being mutually exclusive. This professional development construct focuses on

improving instruction so students will learn more effectively, thus increasing performance (Garet, Porter, Desimone, Birman, & Yoon, 2001). Both instructional and transformational leadership principles often present themselves as ordinal. In the analysis by Vescio, Ross, and Adams (2008), the researchers determined "PLC rests on the premise of improving student learning by improving teaching practice" concluding "[u]ltimately … educators must critically examine the results of their efforts in terms of student achievement" (pg. 82). Increase student achievement is the end-goal accomplished via the process of improved teaching practice. This end-goal focus on student learning was also found to be the key to increased achievement in multiple PLC studies (Berry, Johnson, & Montgomery, 2005; Hollins, McIntyre, DeBose, Hollins, & Towner, 2004; Louis & Marks, 1998; Phillips, 2003; Strahan, 2003; Supovitz, 2002; Supovitz & Christman, 2003).

Principal Vision

One attribute in multiple leadership theories, including transformational and instructional leadership, is an emphasis on the importance of the development and pursuit of a vision (Hallinger & Heck, 2002; Robinson et al., 2008). Vision statements are not universally defined constructs in literature. The term is used to describe multiple phenomena: the force molding meaning for people within an organization (Mariasse, 1985); a goal-oriented mental construct (Seeley, 1992); a formative force field leaders can use to create a power (Wheatley, 1999). Vision statements may be used in a variety of complex ways with a variety of interchangeable terms such as personal agenda, purpose, legacy, dream, goal, mission, philosophy, or values (Kantabutra & Avery, 2002, 2007; Rahimnia, Moghadasian, & Mashreghi, 2011). Regardless of which term is used, it is generally accepted that vision is an important prerequisite for positive change within an organization (Barnett & McCormick, 2003; Daft & Lane, 2005). Instead of

seeking for a universally accepted definition, this study adopts the approach of Baum, Locke, and Kirkpatrick (1998) and Kantabutra (2003) in defining the term "vision" as something that each individual leader defines. Despite the various terms that may be used, research has attempted to break down vision statements into measurable characteristics. (Larwood, Falbe, Kriger, & Miesing, 1995) identified ten meaningful attributes of visions. Others including Baum et al. (1998) and further explored by Kantabutra and Avery (2007) narrowed the list to just seven items—brevity, clarity, abstractness, challenge, future orientation, stability, and desire or ability to inspire.

The Comprehensive Mathematics Initiative Professional Development

Districts and schools nationally have implemented various programs over the years to develop students' mathematics understanding, with little to no meaningful or sustained impact on instructional methods or student achievement. Teachers often fail to fully recognize the value of developing a deep mathematical understanding in students. In many cases, teachers do not realize that this deeper level of understanding exists because they lack meaningful mathematical understanding themselves. Traditional mathematic professional development has not been highly effective in bringing about systems change because it fails to target the teachers' own deficiencies in mathematics. Not surprisingly, this results in the inability for many teachers to transfer and develop a deep mathematical understanding in their students.

The Comprehensive Mathematics Instruction Professional Development (CMI PD) was created as a collaborative project between Brigham Young University's math and education departments as well as multiple northern Utah school districts. Its goal is to provide K-12 mathematics instructors access to strategies designed to "bridge the gap between the good pedagogical strategies of traditional instruction and the recommendations of reform-based

instruction" (Hendrickson, Hilton, & Bahr, 2008, pg. 3). The CMI PD attempts to provide a practical method of increasing teacher efficiency in mathematics instruction in order to develop a deeper understanding of mathematical concepts in students.

The CMI PD is focused on developing the capacity of the teacher by improving their understanding, attitudes, and pedagogy with regards to mathematics. Since 2004, over 45 elementary schools throughout Utah have participated in the CMI PD with varying levels of success in increasing schoolwide student achievement on state standardized mathematics exams.

APPENDIX B

Extended Methods

Population and Sampling

It was determined that a semi-structured interview with principals whose schools had participated in the CMI PD would provide the best data from which answers to the study's research purposes could be derived. To that end, this study attempted to interview all principals whose schools had completed the CMI PD from 2004 (when the program was first piloted) to 2016 (when the study began). A list of potential interviewees was generated with the assistance of Professor Sterling Hilton, one of the CMI PD architects, who was involved with all implementations of the CMI PD during this time-period. Using this census method, a target population of 27 principals from 24 schools was identified. While the vast majority of the principals were no longer at their original participating schools, current contact information for 24 of the 27 principals was available. Sterling Hilton initially contacted each of these principals via email and invited them to take part in the study, utilizing his personal connection with each participant as a motivation to participate. Subsequent emails and phone calls were made to the potential participants from the primary researcher regardless of their reply to the introductory email from Sterling. Ultimately, 16 principals agreed to participate in the study. Those not participating did not respond to the repeated requests or indicated unavailability due to time constraints. While there was no sampling of a population by the researcher involved in this study, due to the ability of each participant to choose to participate introduced an element of convenience sampling in that participants were ultimately selected based on their availability and willingness to take part in the study. This ultimately introduces a potential for meaningful volunteer bias and is a known risk of any non-probability sampling method. To ensure

individuals and schools could not be identified, each respondent was assigned a unique identifying pseudonym which is referenced in this study when an individual participant's comment or insight is used.

The 16 principals interviewed were located at elementary schools in five districts along the Wasatch Front across northern Utah and represent a diverse set of economic factors and demographic characteristics. School size varied and represented rural, urban and suburban schools. Socioeconomic variations were present with those participating schools with 7 of the 16 qualifying as Title 1 schools

Table 1

Principal and School Demographics

Principal Sex	Male: 7	Female: 9
Highly Successful	Male: 4	Female: 5
Moderately Successful	Male: 3	Female: 4
Principal Age (when interviewed)	Average: 49	Range: 39 – 61
Highly Successful	Average: 51	Range: 42 – 61
Moderately Successful	Average: 47	Range: 39 – 58
School Title 1 Status	8 of 16 (50%)	
Highly Successful	4 of 9 (44%)	
Moderately Successful	4 of 7 (57%)	
School Enrollment	Average: 626	Range: 418 – 1014
Highly Successful	Average: 648	Range: 472 – 828
Moderately Successful	Average: 598	Range: 418 – 1014
School 4-Year Post CMI-PD Gain in Math Performance	Average: 8%	Range: -3% - 16%
Highly Successful	Average: 12% σ: 3.9%	Range: 5% - 16%
Moderately Successful	Average: 2% σ: 3.2%	Range: -3% - 5%

The 2-sample t-test was 5.56 with a p-value < 0.0001
The 95% CI between the highly and moderately successful groups was 5.5% to 13.2%

Approach and Procedures

Interviews were conducted over a six-month timeframe from March 2017 to September 2017. Study participants were interviewed in person at their administrative offices or remotely via webcam. All interviews were captured on video with a backup audio recording for subsequent transcription and observation of nonverbal cues. All digital recordings were saved on a password protected cloud drive and accessed from computers with similar security measures. Participants responded to semi-structured questions designed to elicit responses which would provide the data to answer the questions posed in this study. For example, principals were asked specific questions such as "Describe how you prepared yourself and your faculty for the CMI PD in your school." and "What are the most significant things you did to contribute to the level of success your school achieved in CMI?" While both of these representative questions were asked of all participants, the order in which they were presented in the interview may have varied. Additionally, based on the particular responses provided, potentially unique follow-up questions were asked in order to more fully understand and capture the intent and detail underlying the original response or in order to explain and provide further clarification for perceived contradictions.

Our interviewer is not an employee of any school district, not considered a functional peer as a school administrator, and not directly associated with the implementation of the CMI PD at any school. This professional distance invited an open, less-threatening atmosphere which encouraged the respondents to provide an honest assessment of their experiences and insights regarding participation in the CMI PD. The interviewer avoided providing verbal or non-verbal affirming or condemning cues which would affect participant responses.

Research Design

An open-ended interview process was determined to be the most effective method of data collection for the study. An outline of potential questions was created. It was not anticipated that the study would use the outline as a strict roadmap, but rather, the outline was used as a guide to facilitate deep, natural discussion sufficient to provide comparative data among subjects. Due to the changes to the CMI PD over time, questioning was focused only on those common elements that persisted across all implementations of the CMI PD over the 12-year span. For example, all implementations of the CMI PD incorporate implementation teams, lesson studies and observations. The research was also designed in such a way that the interviewer was not in a position of power or influence over the participants, thus aiding in the facilitation of honest and open responses.

The purpose of this study was not necessarily to answer each of the predetermined research questions outlined below, rather, the researcher allowed the emic nature of this study to dictate where potential patterns for analysis may emerge. The preliminary research questions were included in order to provide some structure to the interview and initial coding process. Three research questions were selected for this purpose:

- Research Question #1 – What vision did principals at participating schools have with regards to the CMI PD? Are there differences in these stated visions for highly successful principals versus moderately successful principals?
- Research Question #2 – What were the principals' role perceptions at participating schools with regards to the CMI PD? Are there differences in these role perceptions for highly successful principals versus moderately successful principals?

- Research Question #3 – What actions did principals at participating schools engage in during the years of CMI PD? Are there differences in these actions for highly successful principals versus moderately successful principals?

As mentioned above, the principals in this study participated in the CMI PD over a 12-year period. Concerns regarding the potential memory biases based on the individual differences in the time since the CMI PD implementation were identified as an unavoidable limitation during the research design phase of the study. All efforts were made in the organization, structure, and content of the questions in order to elicit comparable responses and limit these memory biases.

Data Collection

During the interviews conducted, open ended questions were asked of each research participant according to the general outline created in the research design phase of the study. Each interview was videotaped, transcribed, and analyzed using the research questions as a framework for examination. The 16 interviews resulted in over 500 minutes of analyzed video and hundreds of pages of transcribed and observation data. Each participant's transcript responses were then entered into coding software (NVivo) for further analysis.

Data Analysis

Data collected was analyzed using a constant comparative method within and across cases in order to identify patterns and relationships (Eisenhardt, 1989). While preliminary research questions were identified for the purposes of providing structure to each interview, the primary goal of this study was to allow theoretical explanations to emerge from the data based off of a grounded theory approach (Glaser, 2002). All three stages of data analysis were conducted, including open, axial, and selective coding.

The initial rounds of open coding were guided by a focus on principal efforts, specifically, the expressed vision, role perception and actions undertaken by each participant. Due to the emic nature of this study, subsequent rounds of open coding allowed expansion and deviation from these focuses as we utilized the software to break down and organize the significant amount of data in an effort to tell a cohesive story. This process, validated through member checking, allowed responses to be organized into ever evolving parent, child, and grandchild nodes. Often, a new idea would emerge from a principal's responses late in the coding process necessitating a need to review all prior coded interviews in order to capture the same phenomenon. For example, initially the general brevity of the vision statements was not identified during the coding process, however, as a pattern of brief versus more complex statements was observed, prior coded transcripts were revisited to capture this idea. This process ultimately resulted in nearly 500 unique parent, child, and grandchild nodes created with over 5,500 references captured. Reference length ranged from a few words to multiple paragraphs.

Open coding is a long and often tedious process, but critical in order to provide context and a hierarchal structure to the data. This allowed for full-emersion into the principal responses and provided for a greater understanding of potentially relevant themes. As this open code, review, and repeat process continued, over time, new codes were no longer being identified signifying saturation and a sign that the next stage of coding could begin.

When determining the success of any endeavor, it is critical that achievement be adequately defined. Many key performance indicators could be used for measuring organizational success including student satisfaction, staff satisfaction, and economic efficiency. For the purposes of this study, student achievement has been suggested as an appropriate performance indicator for school success (Hanushek, 1986). In the context of the CMI PD, one

measure of student achievement is performance on state, end-of-level mathematical tests. For the purposes of this paper, schools and their respective principals are denoted as “highly successful” or “moderately successful” as measured by student performance on these tests as detailed below. In order to limit any bias in the data collection and data analysis process, classification of a school’s relative “success” in the CMI PD did not occur until after the interview and open coding of the responses.

Data from the Utah mathematics Criterion-Reference Test (CRT) and from the Student Assessment of Growth and Excellence (SAGE) were analyzed for each school whose principal participated in the study in order to categorize school success. The highly successful group saw an average improvement in student performance over a 4-year period of roughly 12% (nearly 3% per year) with a standard deviation of 3.9%. In the moderately successful group, the average improvement over a 4-year period was still positive, but less pronounced with a mean improvement of 2%% with a 3.2% standard deviation (see Table 1).

Axial, and selective coding compared principal responses against the classification of the school as highly or moderately successful and allowed the data to be reconstructed in meaningful ways (Marshall & Rossman, 2010). In axial coding we compared the patterns identified in open coding in order to identify new patterns based on a multi-dimensional analysis comparing patterns against patterns (Creswell & Poth, 2017). We utilized selective coding to focus on specific patterns in order to identify explanatory themes to the study phenomena (Marshall & Rossman, 2010). This process is primarily focused on providing explanation and supporting evidence of the data in a way that can be meaningful to others (Straus & Corbin, 1990). The processes between open, axial, and selective coding is inherently ordinal, however, there are

iterative elements to this exercise requiring a return to a prior step occurring over the course of multiple months as new patterns and themes were identified and explored.

A threshold of 75% was used to establish themes when considering the 16 principals as a group. When comparing themes between the highly successful and moderately successful groups during axial coding, patterns were established using a threshold of 50% in at least one of the groups and a 20% threshold in the difference between the two groups. Multiple responses on the same node by the same participant were noted but were not factored in during the establishment of thresholds.

Reporting Conclusions

In order to provide value for scholars and practitioners, all aspects of a research process must be conducted in a trustworthy way. Without this trust, the applicability and soundness of the findings and conclusions are questionable at best. Elements of trustworthy research include credibility, applicability through transferability, consistency through dependability, and neutrality through confirmability (Erlandson, Harris, Skipper, & Allen, 1993).

For a study to be credible, there must be capability between any conclusions drawn and the reality of the representations made by study participants. Credibility validation during the data analysis process can occur through peer debriefing, often with co-researchers having more experience and understanding of the study material and its underlying theories. For our study, peer debriefing during data analysis occurred with a number of sources including the dissertation chair—Sterling Hilton—and numerous committee members providing essential direction and perspective.

Transferability relies on a reader's ability to apply study findings to other related situations. This element is known to be difficult in qualitative studies as an inherent limitation is

its inability to be generalized beyond the sample population. While we acknowledge this lack of generalizability in this study, value can still be derived in qualitative research as a means of providing opportunities for knowledge transfer that can provide value in other settings (Erlandson et al., 1993). To further increase transferability, this study utilized a robust data analysis process and provided a clear description of the methods employed with representative responses from each participant to allow the reader sufficient data in order to make their own assessment of the findings and its similarity to their particular environment.

In order for a study to have a high degree of dependability it should be able to be repeated with similar results (Erlandson et al., 1993). This study did not seek to encourage or prompt replicability due, in part, to the specific nature of the study population. Instead, the study relied on a dependability audit in order to maintain trustworthiness. Through precision transcription, external checks, peer reviews, and careful analysis all recorded and summarized in this study, its readers are able to follow the study process and understand its conclusions,

Similar to dependability, confirmability allows a reader to track the findings back to its original source. A detailed audit trail and process description helped walk the reader, step-by-step, in the analysis process allowing them to see the inherent results of the data.

APPENDIX C

Consent Form

Consent to be a Research Subject

Introduction: This research study is being conducted by Chad Staheli, a doctoral student at Brigham Young University's College of Education to evaluate the effect elementary school principals have on the CMI professional development. You were invited to participate because you have been the principal at a school which participated in and completed CMI professional development.

Procedures: If you agree to participate in this research study, the following will occur:

- You will be interviewed for approximately forty-five (45) minutes about your participation in the CMI professional development. With your permission, the interview will be audio recorded to ensure accuracy in reporting your statements.
- The interview will take place at a time and location convenient for you (e.g. at your office). The interview may take place via teleconferencing technology (e.g. Skype) if an in-person interview cannot be arranged.
- The researcher may contact you later to clarify your interview answers.
- Total time commitment will be one hour.

Risks/Discomforts: There is minimal risk to participating in this research study. It is possible that you may experience mild emotional discomfort as you reflect on your actions and participation in the CMI initiative.

The researcher will minimize these risks by taking steps to create a safe, non-judgmental environment. The primary purpose of your interview is to learn about your experiences within CMI and is not meant to suggest that there are any particular right or wrong answers.

Benefits: There will be no direct benefits to you. It is hoped, however, that through your participation researchers may learn about the practices and beliefs of principals that may have a positive impact on future program implementation efforts.

Confidentiality: The research data, including audio recordings, will be kept on password protected computer and secure cloud server and only the researcher will have access to the data. At the conclusion of the study, all identifying information will be removed and the data will be kept in a secure electronic format for a period of 5 years, at which time all data will be destroyed. Any hard copies of identifying information will be destroyed once electronically saved. Only aggregated non-identifiable data will be used in reporting study finding to the public.

Compensation: Participants shall receive no compensation for participation in this study.

Participation: Participation in this research study is voluntary. You have the right to withdraw at any time or refuse to participate entirely without jeopardy to your employment or standing at your school.

Questions about the Research: If you have questions regarding this study, you may contact Chad Staheli at (801) 319-4700 or mcstaheli@gmail.com for further information.

Questions about Your Rights as Research Participants: If you have questions regarding your rights as a research participant contact IRB Administrator at (801) 422-1461; A-285 ASB, Brigham Young University, Provo, UT 84602; irb@byu.edu.

Statement of Consent: I have read, understood, and received a copy of the above consent and desire of my own free will to participate in this study.

Name (Printed):_____Signature_____Date:_____

Researcher: Chad Staheli_____Signature_____Date: _____

APPENDIX D

Instruments

Instrument One: Email Invitation to Participate

Dear [Name],

Our work with CMI continues to grow as we work with schools and districts to improve students' mathematical learning. Over the past 10 years, more than 23 schools have completed CMI Professional Development. We've always believed that school leaders have an important role to play in teachers' adoption of CMI principles. Over the years, we've gathered anecdotal evidence that supports this belief. We are now interested in studying this more systematically. A doctoral student of mine, Chad Staheli, is examining this in his dissertation research. We hope to interview all principals whose schools have participated in CMI training. I've given Chad your name and contact information and he will be reaching out to you to see if you are willing to participate in an interview regarding your school's participation in CMI. I would appreciate it if you were able to make the time to talk with him as all of your experiences are valuable and will help us in our future work.

Many thanks and good luck in your current work.

Sterling

Instrument Two: Phone Script to Participate

My name is Chad Staheli. I'm a doctoral student at BYU in the School of Education. Sterling Hilton, my doctoral chair recently reached out to you and introduced the research study I'm conducting regarding the CMI Program at your school. I 1vould like to interview you regarding your participation as the school principal participating in this program. It is anticipated that this interview will last 45 minutes either in-person or via video conferencing at a date and time that works for your schedule. Would you be willing to participate in this interview? If so, when do you have some time available? [Schedule Interview].

Thank you for your time.

Instrument Three: Participant Questionnaire

Participant Questionnaire
Gender:_____ Age: _____ I have been a principal of an elementary school for_____years. *(Note: if you have served as a principal for non-consecutive periods, please indicate the cumulative total number of years).*
Internal Use
Principal ID: School ID:

Instrument Four: Interview Questions

1) Overall Impression of CMI
    a. What was your interest in CMI? How did you come to be involved?
    b. What was your vision for CMI at your school? What did you hope to accomplish (for students, for teachers)?
    c. Tell me about your experiences with CMI. What were your overall impressions?
2) Implementation Process
    a. Describe how you prepared yourself and your faculty for CMI in your school.
    b. How did you feel program implementation went? Did you feel it met your expectations or desires?
    c. What did 'success' look like to you in relationship to CMI? To what extent do you think CMI was successful? Why or why not? In what ways?
    d. What worked during the implementation and operation of the Program? Why?
    e. What didn't work during the implementation and operation of the Program? Why?
    f. What kind of adjustments did you make in order to meet your objectives or respond to specific school needs? How did you make this work at your school?
    g. What are the most significant things you did to contribute to the level of success your school achieved in CMI? Is there anything you would do differently? Explain.
3) Role Perception and Team Dynamic

   a. In addition to yourself, there were off-site and onsite facilitators that helped with the implementation of CMI. What did you understand your role to be in the implementation process? What about the others? What roles did they have?
   b. Describe your interactions and relationships with the other members of the implementation team.
   c. Describe your involvement in the implementation of the Program. What did you do in your role as the Principal?
   d. How important and necessary was everyone on the implementation team to the success of CMI at your school? Explain.

4) Individual Involvement
   a. Describe your involvement in the CMI professional development sessions. How often did you attend? What percentage of time?
   b. Describe your involvement in the implementation team training sessions.
   c. Describe your involvement in lesson study. Did your faculty continue doing lesson study after the CMI professional development ended? Why or why not?
   d. What advice would you give a principal whose school was thinking about implementing CMI?

APPENDIX E

Study Approval

Campus Memorandum

Brigham Young University The Institutional Review Board for Human Subjects

Re: Renewal Application of Approved Research Date: October 1, 2018

From: IRB Secretary
A-285 ASB
Email: irb@byu.edu

To: Chad Staheli
[redacted]

Your renewal application must be approved before your current approval expires. If IRB approval has expired, you cannot enroll new subjects and the research must stop. Studies that have not been re-approved by the expiration date will be closed.

Please send, fax or email one copy of this completed form to the IRB Secretary, Office of Research and Creative Activities, A-285 ASB, fax (801) 422-0620, irb@byu.edu, by the following date. 11-10-2018. **Please respond even if you are done with your research.**

IRB # X 16389 (IRB Use - Date Received)	
Protocol Title	An Investigation of Principal Vision, Role Perception and Actions on Effective CMI Professional Development Implementation
Principal Investigator Chad Staheli Phone # 801-319-4700 Email mcstaheli@gmail.com	
☐ **Close the Protocol. I am no longer actively working with human subjects AND I have completed the data analysis on this study.**	
☒ **The Research is still ongoing. I have attached the following:** ☒ A protocol summary (including your hypothesis and methods or procedures no more than a page long ***and*** ☒ A status report on the progress of the research including: 1. any adverse events, unanticipated problems involving risks to subjects or others and any withdrawal of subjects from the research or complaints about the research since the last IRB review. 2. a summary of any relevant recent literature, interim findings, and amendments or modifications to the research since the last review. 3. any relevant multi-center trial reports 4. any other relevant information, especially information about risks associated with the research 5. a copy of the current date-stamped consent document 6. a clean copy of the current informed consent document and any newly proposed consent documents 7. a clean copy of the current recruiting materials. ☐ **Any new amendments or proposed changes to the next approval period must be accompanied by the Amendment/Modification of Research Form. (if applicable)**	
Number of subjects accrued during the course of this study?	18
How many subjects were enrolled in this study since the last approval date?	18
Signature:	*Date:* 10/25/18

APPENDIX F

Dissertation References

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