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Gaining Insight into the Development of Mathematics Teacher Leaders in Primary Grades: A Multi-case Study

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GAINING INSIGHT INTO THE DEVELOPMENT OF MATHEMATICS TEACHER LEADERS IN PRIMARY GRADES: A MULTI-CASE STUDY

by

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Teacher leaders have the potential to influence improved instructional practice for mathematics within elementary schools and thereby student performance. Lamentably, an insufficient number of elementary classroom teachers, specifically those who teach kindergarten, first, and second grades, participate actively in a teacher leader role, which positively impacts teaching and learning mathematics. Therefore, an examination of how professional development plays a role in cultivating new teacher leaders proves to be critical.

In this qualitative multi-case study, I examined a structured professional development opportunity for K–2 teachers designed to promote their leadership. All participants were full-time classroom teachers within an urban, Midwestern public school district. The focal questions of this study were: *What opportunities and contextual factors do K–2 teacher leaders identify as contributing to their growth as mathematics teacher leaders in mathematics?* and *In what ways does a structured professional learning opportunity promote mathematics teacher leadership in K–2 teachers?* The data analyzed included pre- and post-surveys, written constructed responses, transcripts from semi-structured interviews, field notes from one-on-one meetings, reflective journals, and artifacts obtained during the study.

The analysis in this study suggests K–2 teachers identify opportunities and contextual factors that contribute to their growth as teacher leaders of mathematics. Findings suggest primary teacher leaders in mathematics generally have had a personal experience navigating productive struggle as learners of mathematics and have supportive building administrators. In addition, primary teacher leaders view leadership positively and characterize themselves as a leader. I also found a structured professional learning opportunity promotes leadership in K–2 teachers in these ways: (1) the learning experience contributes to growth, (2) professional resources contribute to a deepened understanding of mathematics pedagogy, (3) self-directed professional learning increases learning, and (4) opportunities for strengthening professional networks.

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CHAPTER ONE: INTRODUCTION

"Within every school there is a sleeping giant of teacher leadership, which can be a strong catalyst for making changes to improve student learning."

— Katzenmeyer and Moller (2009, p. 2)

Teachers play a critical role in students' opportunities to learn mathematics (National Mathematics Advisory Panel, 2008; NCTM, 2014). Teaching has six to ten times as much impact on achievement as other factors, such as curricula, reduced class size, and family involvement (Mortimore & Sammons, 1987). Running parallel to this idea that teaching matters, Sanders and Horn (1994) argue three years of effective teaching in succession can account for an average improvement of 35 to 50 percentile points on students' standardized assessment scores. An emphasis on teaching to increase effectiveness will aid in combating low achievement scores in mathematics in our elementary schools.

Working in Isolation

Historically, teachers have worked in isolation and not shared insights into effective teaching practices. Commonly, teachers remain in their own classrooms and engage in the daily work of teaching without regularly interacting with their peers. This practice of working as individuals does not contribute to widespread instructional improvement or the achievement for all students. Teachers working in isolation is especially true in mathematics, a content area in which teachers traditionally do not come together to discuss effective instruction (Stigler & Hiebert, 1999; NCTM, 2014).

Teachers need to be encouraged to work together in order to improve instruction (Donaldson, 2001; Hadar & Brody, 2010; Hargreaves, 1994; Larson et al., 2012; NCTM, 2014; Schmoker, 2006; Talbert & McLaughlin, 1994). In *Principles to Actions: Ensuring Mathematical Success for All* (NCTM, 2014), the National Council of Teachers of Mathematics [NCTM] suggests teachers of mathematics must overcome the traditional culture of professional isolation to decrease the inconsistencies in practice so all students can achieve success in mathematics. NCTM strongly advocates for educators to hold both themselves and their colleagues accountable for the success of every student, as well as for their personal and collective growth toward effective teaching and learning of mathematics (NCTM, 2014). The longstanding instructional traditions within mathematics education must be challenged and replaced with more effective pedagogical practices. Overcoming these traditions appears challenging, due to the stability of teaching practices over time and that cultural activities, by their nature, are highly resistant to change (Stigler and Thompson, 2009).

Professional Support

For teachers to overcome working in isolation and grow in their craft by working toward mathematical success for all students through collaboration, teachers must receive adequate professional support. On-site building-based resources play a vital role in breaking up the culture of isolation and for instituting change in teacher practices (Campbell & Malkus, 2011). Ultimately, building administrators become accountable for promoting teachers' professional growth. However, in many cases, principals cannot fully commit to this role due to the number of different responsibilities they have as a building administrator (Fuller et al., 2018).

Additionally, elementary principals often do not feel equipped in the area of mathematics. Many have personal hesitations and/or feel inadequate about providing instructional leadership for math (Perry & Reade, 2018). Therefore, they tend to avoid the discipline and rarely offer suggestions regarding effective pedagogical practices for the subject. Spillane and Kim (2012) found that school principals commonly do not hold a prominent place in the mathematics advice networks at their schools. In this study of thirty buildings, findings indicated that teachers sought out principals for advice or information in regard to mathematics in less than one third of the buildings. In buildings where teachers did go to the principals, the interactions involved fewer than five teachers. This study indicates that teachers seek out people other than administrators in buildings in regard to finding out ways to improve their mathematics instruction.

Many elementary schools employ an instructional coach to address the need of instructional improvement. Approximately one out of four schools have an instructional coach (Kraft & Blazar, 2018). Whether a part-time or full-time position, the charge of the coach remains the same. Instructional coaches collaborate with teachers in a number of ways to enhance teacher quality in a specific content area. According to Sutton et al. (2011), teacher practices improve through collaboration, maintaining a sharp focus on research-informed instructional strategies, and content that involves the why, what, and how of teaching mathematics.

A number of elementary settings across the country employ instructional coaches; however, many teachers do not have access to such resources. In addition, instructional coaches more often have literacy or general instruction expertise than they do for mathematics (Kraft & Blazar, 2018). In absence of an instructional coach in an

elementary building, or the lack of specialized knowledge in mathematics within an instructional coach, teacher leaders, or classroom teachers who assume informal, nonsupervisory leadership roles, can create and develop working relationships with colleagues for the explicit purpose of addressing classroom challenges and enhancing instruction (Mangin & Stoelinga, 2008; Smylie, 1992). The work of teacher leaders can have an impact on the professional learning of others and make a difference at the classroom level (Killion & Harrison, 2006; York-Barr & Duke, 2004). Teacher leaders have the potential to be among the most influential leaders in schools (Curtis, 2013; Wenner & Campbell, 2017).

Teacher Leaders

Building-based teacher leaders, viewed by their peers as resident experts in mathematics content and pedagogy, can become the central figure in the mathematics network of their school (Spillane & Kim, 2012). These teachers tend to have stronger working connections with their peers compared to the relationship with their principal or coordinator. Teacher leaders become the most prominent "go to" colleague for issues related to mathematics teaching and learning. Due to this relationship, among building staff related to mathematics within an elementary building, teacher leaders can have a positive impact on the interactions that associate with shifts in the beliefs and practices of teachers (Hopkins et al., 2013; Katzenmeyer & Moller, 2009).

Teacher leaders can play a pivotal role in making change happen as "they are close to the ground and have the knowledge and ability to control the conditions for teacher learning in schools and classrooms" (Lieberman & Miller, 2004, p. 12). Teacher leaders not only share in the accountability for promoting student learning, adult learning,

and collaboration within mathematics but also for overall school improvement (Riggs, 2013). In addition to teacher leaders contributing to refinements in teaching and learning mathematics at the school, teacher leaders personally benefit. When a teacher leader engages in leadership, their self- confidence is impacted (McBee, 2015). Teacher leaders feel more respected and, as a result, tend to raise professional expectations of themselves as a result (Lieberman, 2015). Fullan and Hargreaves (1996) believe teachers who assume a teacher leader role become empowered to facilitate difficult yet important and necessary work among their peers, having an ultimate impact on student achievement.

While the work of a teacher leader holds great promise for instructional improvement, only a small number pursue such a role. Approximately 25% of teachers are interested in the hybrid role of being a classroom teacher and assuming an informal, nonsupervisory leadership position (Riggs, 2013). This relatively low percentage may be due to the fact that a number of classroom teachers find this more administrative-like work unappealing and/or they view the added responsibilities on top of their already full workload as overwhelming (Wenner & Campbell, 2017). Other teachers may be lacking the content or pedagogical knowledge needed to contribute to developing instructional practices in others as a means for increased student achievement (Ball et al., 2005). Some may simply not see themselves in a leadership role (Sinha & Hanuscin, 2017). Therefore, the actual practice of teacher leadership does not prove to be common (Birky et al., 2006) within today's elementary contexts.

Potential exists in creating powerful working relationships with other teachers when informal leadership positions are fostered (Smylie, 2002). "The hope for teacher leadership is the continuous improvement of teaching and learning in our nation's

schools, with the result being increased achievement for every student" (York-Barr & Duke, 2004, p. 225). Collectively, teacher leaders have the potential to overcome the relatively static trend in recent achievement scores in mathematics for our nation's elementary students (NCES, 2017). The influence of the work of teacher leaders can contribute to increased learning for all by advocating and supporting effective teaching practices. In pursuit of the same mission to contribute to the mathematical achievement for all students, this study will take a closer look into the development of mathematics teacher leaders to seek ways to foster this type of leadership within teachers at the primary level in elementary buildings.

Statement of the Problem

The district in which I studied serves approximately 42,000 students from Pre-Kindergarten through Grade 12, and is one of the largest districts in the state. In kindergarten, first, and second grades, there are more than 3,000 students enrolled in each grade level in 2020. Combining these grade levels into one unit, which will be referred to as *primary* for the purposes of this study, involved slightly less than 10,000 students located in 39 elementary buildings. There are approximately 150 teachers at each grade level in the primary grades, which equates to approximately 450 teachers in the district who work at the primary level. These data illustrate there are substantial numbers of students and teachers to impact within the district.

Data from the state's assessment indicated 22% of third-grade students in the district were not meeting proficiency levels in mathematics. These data were similar to that of the next two subsequent grade levels, as 18% of fourth-grade and 22% of fifth-grade students fell below desired expectations. While these percentages seemed relatively

low, they indicated roughly one out of five students in the three grade levels were not meeting mathematics proficiency as defined by the state. These numbers of students not meeting grade level expectations were concerning, as the district charged itself with meeting the needs of each and every student. Teaching makes a difference in student success (Mortimore & Sammons, 1987; Sanders & Horn, 1994), therefore the district decided efforts were needed to make classroom instruction for mathematics more effective. Developing elementary mathematics teacher leaders, who would have a direct reach to classrooms, appeared to be a way to accomplish this goal. Teacher leaders at all grade levels are significant; however, the district believed if students were provided with a stronger foundation of mathematics in the primary grades, the students may be more successful in subsequent grade levels.

The district employed five elementary mathematics district-level coaches who supported mathematics teaching and learning in all 39 elementary buildings. These district-level coaches held a distinct role, different from that of the teacher leaders who remained in classrooms as the teacher of record. The duties of district-level coaches were: supporting teachers' instructional practices in their specific content area, creating and enacting widespread professional development, offering individual coaching to teachers who need extensive assistance, and working with groups such as principals, special education, and federal programs to communicate district expectations, policies, and procedures.

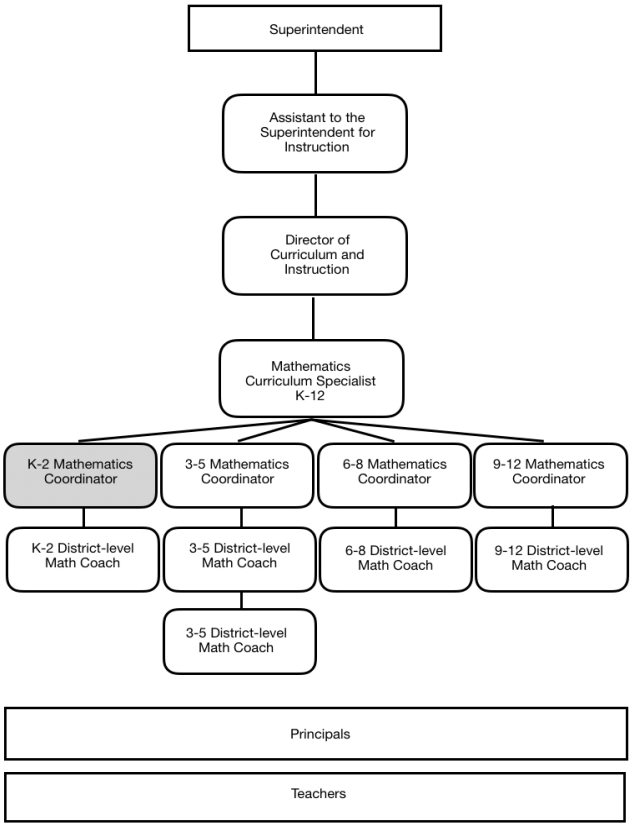
Of the five people who served as district-level mathematics coaches, two of these district-level coaches focused specifically on Grades K, 1, and 2. The remaining three focused their efforts in the intermediate grade levels of 3, 4, and 5. While there are five

total district-level coaches, this number of district-level coaches seemed insufficient for the scope of the work. In the specific case of the primary grade levels, there were only two district-level coaches to work with approximately 450 teachers. I served in one of the two primary district-level coach roles. It appeared unrealistic for myself, and the other primary district-level coach, to work regularly with such a large number of teachers. Therefore, district leaders looked for ways to broaden the reach of mathematics teacher leadership at the primary level. One possible solution was to involve more teacher leaders who would remain in buildings as classroom teachers and assume simultaneous leadership roles. The belief was that these teacher leaders, who taught kindergarten, first, or second grade, could potentially play a pivotal role in increasing the effectiveness of the work that impacts student learning in primary mathematics.

I served my district as the K–2 Mathematics Coordinator. In addition to the duties previously described for the district-level math coach, I was involved with other aspects related to mathematics education such as assessment writing, designing professional learning opportunities for teachers, and working directly with principals to strengthen their understanding of mathematics content and pedagogy. Figure 1 highlights how my role was positioned among the other leaders of mathematics in the district. My role is indicated by the shaded area.

Figure 1

Structure of District Mathematics Leadership



Through my role as the K–2 Mathematics Coordinator, I have been fortunate to work with several elementary classroom teachers who have performed as teacher leaders. Teachers within this group have been committed not only to the improvement of their own instructional practices but also the betterment of other teachers' pedagogical practices. These teachers actively sought opportunities to grow in their own instruction, initiated conversations regarding effective mathematics teaching within grade-level and building-wide teams, and facilitated high-quality professional development opportunities at the district level. Through the efforts of these teacher leaders, many other teachers have

been encouraged to refine their instructional practices to increase student achievement in mathematics.

Small Number of Teacher Leaders in Primary Mathematics

While the efforts of these teacher leaders deserve recognition, a reason for concern existed. First, the number of primary teachers actively engaged as teacher leaders in the area of mathematics appeared relatively small for the size of the district. In addition, many of these kindergarten, first, and second grade teachers who had been engaged as teacher leaders of mathematics in the past no longer actively served in this role within the district. Several factors contributed to this: some former teacher leaders accepted administrative positions to serve as a building's principal, assistant principal, or coordinator, while others moved to an intermediate grade, and no longer taught in one of the primary grade levels. A few accepted other leadership roles in the district, such as district-level literacy coaches. While a number of these teacher leaders made professional changes, others became inactive due to personal reasons or retirement. These different reasons, both professional or personal, contributed to the decline of teacher leaders in mathematics at the K–2 level in the district over that five years.

A number of reasons may contribute to the fact other teachers were not pursuing a new role of a teacher leader in mathematics in the district. Teachers may feel as if they are not qualified for the role or they lacked the depth of mathematics content and pedagogical knowledge they needed to be a leader (Wenner, 2017). Some teachers may perceive teacher leadership as taking additional time on top of their regular duties as a classroom teacher (Smith et al., 2016). Other teachers may be hesitant to take on this role as they did not have a group of other teacher leaders with which to network and from

which to gain support. Some teachers may feel as if they need to be formally asked, instead of venturing into teacher leadership on their own. Whatever the case, the number of teachers becoming active as new teacher leaders remained insufficient.

This decrease in the number of classroom teachers who were active in the area of teacher leadership in mathematics, as well as the small number of teachers pursuing a new role in teacher leadership, left behind many missed opportunities for professional growth as teacher leaders play an important role in this process for all teachers. The decline also compounded the previous issue of not having a sufficient number of teachers assuming these roles. The district is large in comparison to most others in the region; therefore, the need for instructional improvement within the number of employed teachers was a rather sizable task. The district needed to confront these obstacles in order to increase the number of mathematics teacher leaders in elementary schools.

Math Liaisons

To overcome the inadequate number of teacher leaders in the district, professional opportunities to foster teacher leadership within mathematics needed to be developed. A number of initiatives were entertained by leaders in the district's curriculum department leadership; however, many were not feasible due to the time and resources it would take. One possible solution that seemed to have promise was to restructure the design of the district's mathematics liaison group in an attempt to empower teachers who would serve as teacher leaders of mathematics in their respective buildings.

Traditionally, one teacher from each of the district's 39 elementary buildings served as a math liaison. This position was paid, as teachers were compensated for their time and efforts. Each building representative served as a liaison between their respective

building and the district mathematics department. A mathematics liaison attended one after-school meeting each month. District-level math coaches facilitated the meetings. The district mathematics department provided information for liaisons regarding effective teaching and learning in mathematics. Then, the liaison held responsibility for reporting the information to their colleagues in their respective buildings. The role of a liaison in the district originally began as a way of communication, prior to the evolution of conveying messages through technology. With the ease and common use of email and other technological advances, means of communication have become more instantaneous and directive. Therefore, the former responsibilities of a mathematics liaison became unnecessary and were discontinued at the end of the 2017–2018 school year.

In an attempt to redevelop the nature of math liaisons, coupled with the district's desire to foster more teacher leaders in this curricular area, the district mathematics department upheld the district's newly revised expectations for a liaison (see Appendix A) and worked to redesign the previous model of math liaisons. This restructuring was done in pursuit of finding ways to better utilize the strengths of teachers who served in this role. Each liaison would participate for one year, with the goal of each building rotating between a K–2 and 3–5 liaison. By doing so, it was the desire of the district mathematics department to enhance the skills of multiple teachers within the same building over time. During the 2018–2019 school year, there were a total of 39 liaisons, one liaison from each of the elementary buildings in the district. Nineteen of these liaisons were K–2 classroom teachers, while twenty taught in Grades 3, 4, or 5.

The math liaisons attended four liaison meetings over the school year. This structure was in contrast to the ten monthly meetings liaisons required previously. To add

to their professional knowledge, liaisons engaged in professional readings on mathematics pedagogy and leadership. Each liaison was asked to collaborate with their respective Mathematics Coordinator, K–2 or 3–5, in regard to a personally selected goal. The liaisons were compensated for their time. The overall purpose was to empower the math liaisons by having them engage in thinking and reflecting on teaching and learning mathematics so they would become more equipped to potentially assume the role of a mathematics teacher leader within their respective buildings.

District decision-makers charged themselves with thinking critically about how to foster, support, and sustain new teacher leaders in the area of mathematics during this process of restructuring the mathematics liaison experience. This work was pursued with optimism as the district leaders believed, through conscious actions and efforts, the number of teacher leaders who were actively involved in the improvement of teaching and learning mathematics at the primary level in the district would increase and ultimately be a solution to increasing student achievement in the district's elementary schools.

Overview of Pilot Study

As a preliminary study to this larger investigation of teacher leadership in the district, I examined the leadership of K–2 teachers who were successful teacher leaders of mathematics in a pilot project. This pilot study, conducted two years prior, investigated the leadership of a group of six teacher leaders who were among the most active and successful leaders at both the building and district levels. Two teachers from each grade level (kindergarten, first, and second grades) participated, as well as the principals who served in each of the teachers' respective buildings. This ethnographic study allowed me

to gain a better understanding of how the six teacher leaders perceived themselves as leaders and what they felt was needed to be successful as a teacher leader of mathematics in the district.

Research Questions

The central research question of the pilot study was, *What is needed for a K–2 teacher of mathematics to experience success as a district-level teacher leader?* Sub-questions of this inquiry included:

RQ_1: What are the perceived characteristics of a leader in mathematics education?

RQ_2: What supports prove to be useful in a teacher's leadership journey?

These inquiries were designed to gain more clarity on what teacher leaders perceived they needed to support their work as a leader at the district level. The hope that by gathering data, I would grow in my knowledge of what contributed to the teacher leaders' successes, so I could use this new knowledge to better support primary mathematics teacher leaders in the future.

Participants

The participants of this study were chosen through purposeful sampling (Creswell & Poth, 2018; Patton, 2002). Six individuals who participated in the study were selected due to their active engagement as teacher leaders of mathematics in the district. This set of participants would best inform my understanding of my central research question: *What is needed for a K–2 teacher of mathematics to experience success as a district-level teacher leader?*

Each of the six participants of the study were actively involved as teacher leaders in mathematics at the primary level in the district. They contributed to the district efforts by facilitating district-level professional development sessions and providing input on curricular projects and assessments. The six teachers chosen for this study were viewed by their peers as teacher leaders in mathematics at both within their respective buildings as well as at the district level.

While the six participants of the study shared a number of characteristics in respect to teacher leadership in mathematics at the district level, they also had varied years of teaching experience and leadership roles at their building level. Table 1 illustrates each participant's unique characteristics and leadership contributions. Included in the table is the number of years the teacher has worked directly with the current administrator of the building at that time.

Table 1

Pilot Study Characteristics

Study Participant	Grade Level Taught	Years of Experience	Leadership at the Building Level	Leadership at the District Level	Years with Current Principal
Teacher A	K	26	Team Leader	Curriculum Implementation Leader, Assessment Review Committee, New Teacher Orientation Facilitator	4 years
Teacher B	K	11	Team Leader, Led building PD, School Improvement Chair	PD Facilitator, Assessment Review Committee	11 years
Teacher C	1st	14	Instructional Coach	PD Facilitator	2 years
Teacher D	1st	11	Team leader	New Teacher, Orientation Facilitator, Assessment Review Committee	3 years
Teacher E	2nd	6	School Improvement Chair	PD Facilitator, Assessment Review Committee	6 years
Teacher F	2nd	8		Implementation Leader, New Teacher Orientation facilitator	2 years

Table 1 shows that the years of teaching experience varied for the participants in this pilot study. The teacher leader with the most experience had taught for 26 years, while the participant with the fewest years of experience had six. The participants' leadership roles varied and included team leader, school improvement chair, and instructional coach. The number of years each participant had worked with their current building principal varied as well, from two to eleven years. It was vital to this study that the participants brought their own individual context; therefore, the differences in these categories were valued.

Data Collection and Analysis

For this pilot study, I collected data in a number of ways. To begin the data collection, the six participants were asked to provide a brief written response to a common prompt. This prompt was:

> Teacher leadership has many dimensions. Within this complex work, research indicates teachers must develop relationships with others, stay abreast of current issues in mathematics education, understand the facets of professional learning, and maintain a focus on student learning. Please draft your own statement, by including what you feel are essential aspects of teacher leadership and speaking to what you feel contributes to a teacher leader's success. I ask that you kindly limit your response to one to two double-spaced typed pages.

Participants were asked to describe what they felt were essential aspects of teacher leadership and speak specifically to what they felt contributed to a teacher leader's success. In addition to the written response, five of the six teachers convened for a focus group. (The sixth teacher was unable to attend due to a last-minute conflict.) During the focus group, the participants provided insights into their work as teacher leaders, as they

reacted to the questions posed. The group offered additional suggestions of what they felt was necessary for their success as teacher leaders.

In addition to responding to the prompt and being involved in the focus group, the teachers completed a survey that was based on the seven domains of the Teacher Leader Model Standards (Teacher Leadership Exploratory Consortium, retrieved from http://www.teacherleaderstandards.org). These domains include the following:

- fostering a collaborative culture to support educator development and student learning
- accessing and using research to improve practice and student learning
- promoting professional learning for continuous improvement
- facilitating improvements in instruction and student learning
- promoting the use of assessments and data for school and district improvement
- improving outreach and collaboration with families and community
- advocating for student learning and the profession

The teachers' principals were asked to complete the same survey, with regard to describing the teacher leader's work from their respective building.

I analyzed the written and verbal responses through axial coding to look for common themes and examined the responses of the teachers from each question from the survey. Next, I compiled overall trends of the survey data from individual responses and compared the responses of the teachers and principals. Finally, I analyzed the results between the teacher and the principal from the respective building, as well as overall trends in the response of the principals.

Findings

A number of dominant themes emerged through the analysis of the data. To provide insight into the central research question, *What is needed for a K–2 teacher of mathematics to experience success as a district-level teacher leader?,* I will first share the themes that provided insight into *RQ_1: What are the perceived characteristics of a leader of mathematics education?* Next, I will speak to the different supports the teacher leaders found to be useful in their journeys as teacher leaders to address *RQ_2: What supports prove to be useful in a teacher's leadership journey?* Each of the quotations that are included as part of this analysis came from the focus group discussion and the teacher leaders' written leadership statements.

Perceived Characteristics

The teacher leaders felt keeping abreast of the current research and trends in the world of mathematics education is important. They also felt obligated to uphold their scholarly work in order to be "in the know" about best practices for teaching mathematics. All of the six teacher leaders participated in extensive graduate-level coursework that centered on mathematical content and pedagogy. However, the group believed continuing to engage in academic learning to grow in their craft was critical. To do this, they frequently attended professional development sessions offered by the district as well as read journal articles from mathematics journals. One teacher said, "I seek out professional learning opportunities wherever they can be found." One teacher leader described how they gathered new knowledge. "There is always something that can be learned. I was fortunate in that I got to read a few professional resources recently while

my student teacher was teaching." The teacher leaders valued being research-informed and staying current with best practices.

A common theme that emerged about the work of the teacher leaders was that they enjoyed learning from others. "Your motto should always be that 'we are in this together,'" said one teacher leader. Most were active participants in a data team within their building. They said they gained knowledge and insights from grade-level weekly team meetings as well as schoolwide professional development sessions. One teacher leader said, "Not only do I learn during these collaborative work sessions but I also serve as a model by being vulnerable to others." These teacher leaders valued collaborating with others, as they viewed these experiences as opportunities for growth as well.

The teacher leaders felt strongly that a growth mindset was an important part of their work: "It is key to frame yourself as a continual learner." The teacher leaders viewed being open-minded, embracing change, and being sensitive to other's apprehensions to change as contributing to their success. One teacher leader commented, "Being patient, understanding that change is a process, and being sensitive to teachers' fears and resistance to change is truly what helped my work with teachers to make successful changes." The teacher leaders felt by embracing a growth mindset, the teachers they worked with would to. "They work alongside others with a similar mindset," commented one teacher leader when talking about her teammates.

Having a love for the work they engaged in every day seemed to be an important ingredient in the teacher leader's recipe for success. The teacher leaders believed their love for students and teaching, as well as mathematics, contributed to their willingness to learn more, work harder, and persevere through trying times as a leader. "Passion is an

integral part of being a leader," said one teacher leader as they spoke about what contributed to their success as leaders. Another teacher leader added, "You have to radiate love for what you do,"

While the teacher leaders felt they had expertise in mathematics content and pedagogy and viewed this as important components of their leadership, they often viewed themselves as less competent and knowledgeable than their principals perceived them to be. This disparity was particularly the case through the responses in the areas of facilitating improvements, improving outreach and collaboration, and accessing and using research on the survey based on the Teacher Leader Model Standards (Teacher Leadership Exploratory Consortium, retrieved from http://www.teacherleaderstandards.org). Perhaps, the teacher leaders felt they had much more to learn or to accomplish while the principals recognized the teacher leader's expertise. Or the disparities between the principal and teacher leader responses may have been due to the fact the teachers underestimated the scope of their work of the teacher leaders. Whatever the case, these responses suggest that teacher leaders often do not fully recognize the influence of their leadership.

Different themes emerged as a result of this pilot study that provided insight into the characteristics teacher leaders perceived as critical to their success as teacher leaders. The teacher leaders found staying abreast of current research and trends in mathematics education as essential. The teacher leaders enjoyed learning from others and maintained a growth mindset. They embraced an outlook that there was always more to learn and through hard work and effort one would grow in their understanding of mathematics. The teacher leaders in this study did not believe they knew everything, rather they sought

ways to get better and improve. Finally, teacher leaders spoke of the importance of passion for one's work as a love for teaching contributed to their success.

Useful Supports for Teacher Leadership

The analysis of data provided more insight into *RQ_2: What supports prove to be useful in a teacher's leadership journey?* First, the teacher leaders contributed their success through the varied experiences they had to practice leadership. They believed the multiple avenues through which they were able to demonstrate their leadership helped to develop their skills and confidence. These experiences ranged from serving as mentor to a new teacher to providing staff development for a building's staff. The teacher leaders provided multiple examples that illustrated the diversity in a teacher leader's work. These examples also provided more insight into how varied experiences help a teacher leader develop meaningful relationships with others. "A leader builds meaningful relationships that yield mutual respect," said one teacher leader as they spoke about their varied leadership work within the building that contributed to their success. The range of experiences within a building ultimately resulted from the principal, as the building principal presented the teacher leader with the experiences.

The teacher leaders spoke strongly of how a collaborative culture was critical to their success as a teacher leader. The teacher leaders felt collaboration had to be prevalent in all that they did within an elementary school, and collaboration was even more critical when teachers engaged in professional learning. Keeping this collaborative culture in mind, the teacher leaders continually asked, "What is best for our kids?" One teacher leader spoke to this collaboration with her grade-level teammates: "Through conversations, we developed shared visions of strategies, concepts, and skills for students

as well as lesson designs. We made a conscious effort to focus our planning sessions around mathematical ideas and pedagogy. Our intentions were to plant seeds of 'habits' that would grow and mature into norms of practice." The teacher leaders believed they had the potential to increase the positive interactions among teachers regarding math content and pedagogy as well as support teachers as they worked collaboratively to raise student achievement.

The teacher leaders also felt a support network was critical to their work. One teacher described this network as having both formal and informal mentors. The teacher leaders shared that the work of a teacher leader is not always easy, and having others to consult or problem-solve with was crucial to their success. "Having other teacher leaders I can call when I need to talk is important," said one teacher leader as they spoke about how they needed the advice of colleagues at times. The support network of people who provide guidance to the teacher leader served in other functions as well. Collectively, the teacher leaders said one of the most important things this network did for them was to share in their successes. They found it to be important to take time to recognize the many triumphs in what could be, at times, difficult work. The occasional pats on the back, words of affirmation, and small tokens of appreciation from others were valuable pieces to the success of the teacher leaders. "It's the small things along the way," said one teacher leader.

One of the most critical aspects the teacher leaders contributed to their success was having a respected colleague see potential in them when they might not have recognized this in themselves. One teacher leader described this notion: "Having someone believe in me, and serve as my cheerleader along the way, has been one of the

most important parts of my success as a leader. Someone saw something in me that I didn't see myself. They invested in me and gave me opportunities to be a leader. I don't know if I could have done this without this gentle nudge and ongoing support." These teacher leaders found this support from a respected colleague to be invaluable.

The teacher leaders in this study identified a number of supports they felt were useful to the work of a teacher leader. One support the teacher leaders felt contributed to their success was the varied leadership experiences in which they had been involved. The teacher leaders shared a collaborative culture was significant, as without this type of environment they would not have been able to accomplish what they had done. A support network was vital to the teacher leaders, as they identified they needed others to talk to and learn from in regard to the work of a teacher leader. Finally, the teacher leaders in this study identified having someone who believed in them and recognizing what the teacher leader was capable of, often when the teacher leader could not do this on their own. These different supports played a significant role in the teacher leaders' success.

Summary of Pilot Study

In summary, there were a number of new insights I gained as a result of the pilot study that looked more closely at the work of successful teacher leaders in the district in which I work. The pilot study sought to gain more understanding of this central research question and sub-questions: *What is needed for a K–2 teacher of mathematics to experience success as a district-level teacher leader?*

RQ_1: What are the perceived characteristics of a leader in mathematics education?

RQ_2: What supports prove to be useful in a teacher's leadership journey?

Overall, the pilot study provided useful insights into the work of teacher leaders and what they feel they needed to be successful in their work within a specific context. The teacher leaders believed staying on top of current literature and engaging in collaborative work were significant aspects to their leadership. They felt collaboration and a growth mindset contributed to their leadership. While the teacher leaders often did not view themselves as being as qualified as their principals did, they did see themselves as exhibiting different aspects of leadership through their work as a teacher leader. Also, the teacher leaders felt it was vital to have varied experiences and people who served as mentors and members of a support network as they engaged in the work.

While this knowledge was not necessarily generalizable to other situations, the study provided me with new insights regarding the work and development of K-2 teacher leaders in the district. It gave me a richer description of what contributed to their success. I was able to draw upon this newly discovered knowledge when working with other teacher leaders. By completing this investigation, I also developed new questions and wonderings. Therefore, I chose to continue my investigation of teacher leadership to explore more facets of teacher leadership development in the study with a larger number of participants.

Conceptual Framework

A framework is "a set of ideas, principles, agreements, or rules that provides the basis or the outline for something that is more fully developed at a later stage" (Lester, 2005, p. 458). To frame my ideas in regard to teacher leadership and how my thoughts are positioned to affect student achievement, it was important for me to develop a

conceptual framework. This conceptual framework attempts to describe my conceptualization of teacher leadership in the context of elementary mathematics. Included within the framework are teacher leadership, the concept I chose for my investigation, other closely related concepts, and anticipated relationships.

In creating this conceptual framework, I used the knowledge I gained from my pilot project, previous research, and my personal knowledge as a practitioner in mathematics education (Lester, 2005). The visual illustration provided a structure as I conceptualized and considered aspects related to teacher leadership as I designed my research study. Here, I explain how I arrived at what was included within the framework.

Professional development, or experiences teachers engage in to become more skilled in their craft, have the potential to influence teaching practices (Guskey, 2002). Therefore, professional development lies at the far left of the framework, as it can influence the practices of teachers that can impact student achievement. Professional development opportunities that include content knowledge and focus on what to teach and how students learn is considered most effective (Kennedy, 1999; Loucks-Horsley et al., 1998). Therefore, I housed mathematics content and mathematics pedagogy within the broader idea of professional development.

While professional development has the potential to influence teachers' practices in mathematics, additional results may occur. Rogus (1988), along with Wenner and Campbell (2017), believe teacher leaders obtain valuable knowledge and skills by participating in learning opportunities that target particular areas to foster their leadership development. The more teachers explore ideas associated with leadership, it is assumed more choose to become active as a teacher leader. As a result, this leadership may

influence the teaching practices of a broader community and potentially increase student achievement. Therefore, leadership was another topic of focus for professional development housed within the professional development container on the framework (see Figure 2). The arrows in Figure 2 connect this topic to effective teaching practices, teacher leadership, student achievement, and teacher identity, as potential relationships among these ideas exist.

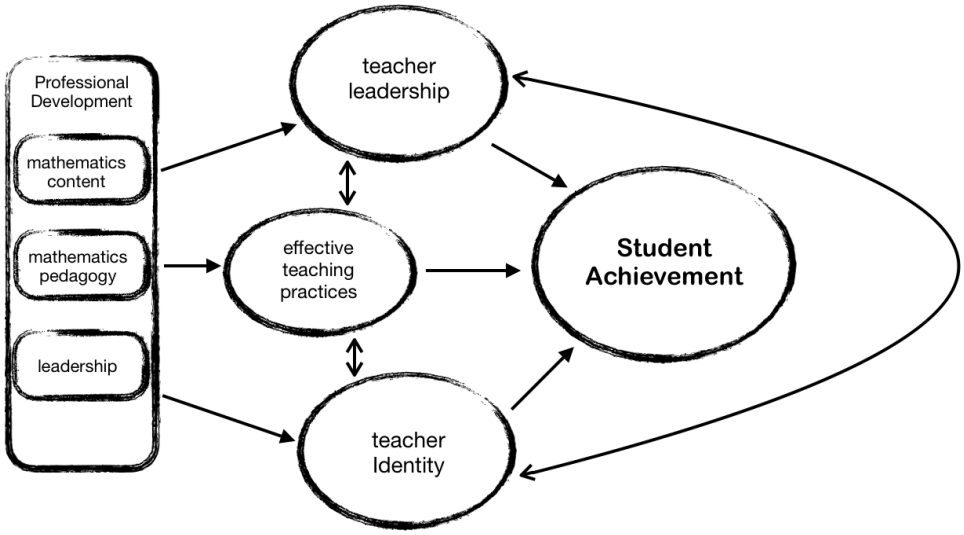
When a teacher gains more knowledge of content and pedagogy, their identity as a learner of mathematics can potentially change. Teachers often alter their personal perspectives as a result of their professional learning (Avraamidou, 2014). The arrows in Figure 2 that run from professional development to teacher identity illustrate this correlation. While professional development can have an effect on a teacher's identity, other factors may influence their identity as well. When teachers transform their identities as a teacher over time, the process often assists them to define themselves as leaders (Ross et al., 2011). Often when teachers engage in leadership they grow professionally, their identities change (Wenner & Campbell, 2017). The arrows between professional development, effective teaching practices, teacher leadership and teacher identified on the framework highlight these intersecting relationships (see Figure 2).

On the right side of the framework in Figure 2 is student achievement, as academic success remains the goal for all students. All arrows on the framework lead to student achievement; however, there are many pathways to get to this end result through professional development, effective teaching practices, teacher leadership, and teacher identity. My framework highlights the complexity of the work and different factors that

have the potential to contribute to student achievement in mathematics. I used this framework to organize my study, as well as to select codes and analyze the data.

Figure 2

Conceptual Framework



CHAPTER TWO: REVIEW OF LITERATURE

This section offers insights on the existing research and literature regarding the factors related to elementary teacher leadership to better understand what is known about teacher leaders and to uncover where additional research is needed to more fully comprehend how to catalyze and support the development of teacher leaders within mathematics. This review of the literature begins with a discussion of how teacher leadership is defined, followed with general insights into the work of teacher leaders and characteristics of effective teacher leaders. Moving specifically into mathematics, a discussion of the literature is shared regarding teacher leadership. Next, I speak to the components of effective professional development and what specifically contributes to a teacher leader's development and success. After discussing professional development, I move to research on teachers' identities as leaders. To close this section, I share my insights of the gaps in literature regarding teacher leadership in elementary school mathematics and where additional research may be needed.

Defining Teacher Leadership

Examining the extensive literature on teacher leadership revealed that few authors provided a specific definition of teacher leadership (Wenner & Campbell, 2017; York-Barr & Duke, 1994). This lack of a detailed description could be due to the large scope of work that tends to fall under this term. As a result of an extensive literature review, York-Barr and Duke (1994) initially suggested teacher leadership was "…an idea that emphasizes that teachers hold an important and central position within the schools." In order to conduct their own review of literature over a decade later, Wenner and Campbell

(2017) crafted a working definition. Wenner and Campbell defined teacher leaders as "teachers who maintain K–12 classroom-based teaching responsibilities, while also taking on leadership responsibilities outside of the classroom" (p. 5). York-Barr and Duke and Wenner and Campbell offered general interpretations and provided a sense of what teacher leadership was within schools. While these broad definitions encompassed the idea that all teachers had the capacity for leadership, they did not assume that all teachers would or should go above their typical duties (Spillane & Diamond, 2007).

Several authors provided a description of the work of teacher leaders (Childs-Bowen et al., 2000; Fullan, 1994; Wasley, 1991). Common themes tended to run through these descriptions, which included guiding instructional improvement, building collaboration, and initiating change. Childs-Bowen et al. (2000) argued "…teachers are leaders when they function in professional learning communities to affect student learning; contribute to school improvement; inspire excellence in practice; and empower stakeholders to participate in educational improvement" (p. 28).

Educational experts often situated definitions of teacher leadership within the context of where the work took place. Danielson (1996) said teacher leadership was demonstrated by teachers who possessed certain skills to influence students in a variety of different environments, including those outside of the classroom. Some researchers who studied teacher leaders spoke to the influence teacher leaders had both within and beyond the classroom (Katzenmeyer & Moller, 2009; Wenner & Campbell, 2014). Crowther and colleagues (2002) included how teacher leaders' influence goes beyond the walls of a building, to link the school and community together in the quest of advancing the community's mission. "Teacher leadership is about action that transforms teaching

and learning in a school, that ties school and community together on behalf of learning, and that advances social sustainability and quality of life for a community" (Crowther et al., 2002, p. xvii). These varying descriptions illustrate the breadth of a teacher leader's actions.

While it is difficult to capture the complexity, scope, and ambiguity of the role with a single definition or description, understanding the term "teacher leader" is important as it may mean something to one person and hold a different meaning for another. However, the purpose of the work of all teacher leaders remains common in that it is targeted at educational improvement. I provided my own definition of teacher leadership, as this was important for me to frame my thinking for my work. For purposes of my study, I subscribe to the definition of a teacher leader as: *a teacher leader is a classroom teacher who takes on leadership responsibilities meant to improve pedagogical practices in their school to increase student achievement.*

The Work of Teacher Leaders

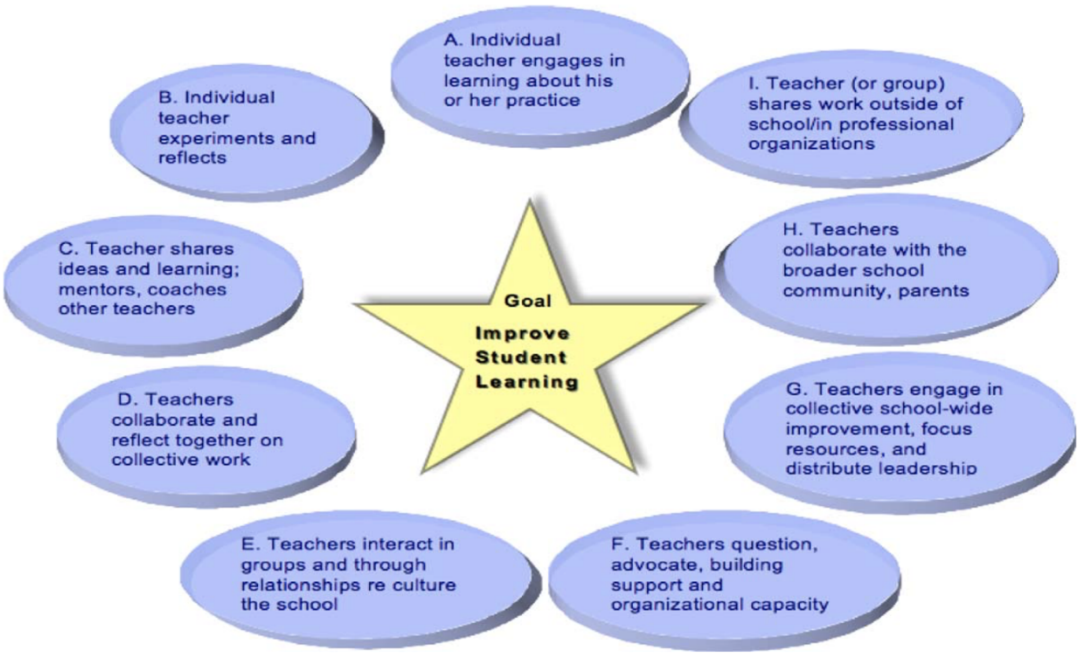
Teacher expertise plays a fundamental role in improving teacher quality and making refinements to teaching and learning. Teachers who serve as teacher leaders are positioned to promote change within the school context because teachers are knowledgeable about the daily work within classrooms and complexities of teaching (Mangin & Stoelinga, 2008). Belasco and Stayer (1993) referred to this aptitude as intellectual capital, as teachers are sources of ideas and knowledge that can be used to improve the instructional practices within a school if the teacher's contributions are used in the right manner. Teachers have the knowledge and ability to control conditions for making change in student learning (Lieberman & Miller, 2004).

Teachers practice leadership in myriad ways. Some roles may be formal, such as a math coach, department chair, or mentor. Other leadership roles tend to be less formal, such as facilitating a grade-level planning meeting, modeling an effective teaching practice, or leading a discussion around a jointly read article. Darling-Hammond et al. (1995) described teacher leadership as embedded in the normal tasks and roles of a teacher without creating a type of formal hierarchy or position. These authors suggested teacher leadership was commonly an expansion of a classroom teacher's typical role, as the teacher would not gain authority or monetary rewards as a result of the work. Additional findings support this idea that a teacher leader does not receive compensation or a title for their work, as formal teacher leadership roles bestowed differentiated status on teachers may conflict with the norm of professional equality (Smylie, 1992).

Fairman and Mackenzie (2012) offer a conceptual framework to describe the varying contexts in which teachers engage in leadership to positively affect change in educational settings. Building upon the theoretical framework of York-Barr and Duke (2004), Fairman and Mackenzie suggested the foundations of teacher leadership come from the teachers themselves, the type of work they engage in, and the educational context. Figure 3 illustrates their "Spheres of Teacher Leadership Action for Learning" (Fairman & Mackenzie, 2012, p. 231).

Figure 3

Spheres of Teacher Leadership in Action (Fairman & Mackenzie, 2010)



The spheres are placed in a circular fashion to illustrate the non-linear and non-continuous work of teacher leaders. Teachers move in and out of these various leadership activities, while building relationships and fostering collaboration (Acker-Hocevar & Touchton, 1999). Improved student learning remains at the heart of this model. Fairman and Makenzie (2010) also found teachers, not administrators, primarily initiated the actions within each of the nine spheres. Perhaps this can be contributed to the teachers' passions for helping all students succeed. Based on this research, Acker-Hocevar and Touchton (1999) suggest professional development for teacher leaders be meaningful for teachers and support their focus on student learning.

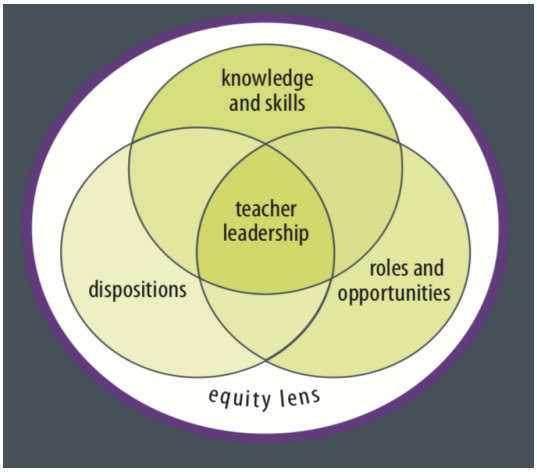
Who are the people doing this work of teacher leaders? Katzenmeyer and Moller (2009) suggested three different adjectives that describe a teacher's readiness to assume the roles and responsibilities of becoming a teacher leader. Potential teacher leaders are "competent, credible, and approachable" (Katzenmeyer & Moller, 2009, p. 14). Through their work, these authors found teachers with notable teaching skills and a well-defined personal philosophy were more likely to become leaders than those who did not exhibit these characteristics. In addition, teachers with an interest in influencing others toward improved practice are likely to be willing to tackle the difficult work of initiating and supporting change. Finally, teacher leaders emerged from those who were at a point in their careers and in their personal lives where they felt they could give to others. These findings suggest teachers possess certain characteristics that contribute to their success as leaders.

The Center for Strengthening Teacher Performance (CSTP; 2018) developed a teacher leadership skills framework that provides a visual model of the characteristics and conditions they suggested need to be present for teacher leadership to be effective. In Figure 4, three interlocking circles converge to indicate teacher leadership. One circle represents the knowledge and skills The Center for Strengthening Teacher Performance [CSTP] feels teacher leaders must possess to be successful. This circle encompasses what CSTP (2018) considers as a crucial aspect: knowledge of content and pedagogy. The second circle represents the roles and opportunities a teacher may experience that contributes to their leadership. The third circle characterizes the disposition of the teacher. All three circles are housed within an equity lens. It is at the intersection of

knowledge and skills, dispositions, and roles and opportunities where CSTP feels teacher leadership takes place.

Figure 4

Teacher Leadership Skills Framework (CSTP, 2018)



Both personal and environmental factors contribute to the success of a teacher leader (York-Barr and Duke, 2004). Smith, Hayes, & Lyons (2016) examined the trajectory of teachers who completed a math coach preparatory program, served as a coach, and then transitioned back into a full-time teaching role in the classroom. These teachers found that simultaneously serving as a teacher leader and classroom teacher required a significant amount of time to balance their classroom and leadership opportunities. One might assume a teacher who had been a mathematics coach in the past would have the skills and competencies necessary to do the leadership work in addition to being a classroom teacher. However, Smith, Hayes, and Lyons (2016) proved this theory was not necessarily the case.

Teacher Leaders in Mathematics

While there has been much written about teacher leadership, the literature that addresses teacher leadership specifically in mathematics education is not as plentiful. In an empirical study of literature on teacher leadership, Wenner and Campbell (2017) found only four studies that focused on the intersection of teacher leadership and mathematics education. They noted that within these four pieces of literature, the discipline of mathematics did not play a significant role in the research at hand. Rather, mathematics provided a context for the study, but the discipline was not a major factor of the work.

The school subject, or content, plays an important role in the work of a teacher leader. Spillane and Hopkins (2013) assert that research around teacher leadership "must take the school subject into consideration, because instruction is not a generic or monolithic variable but rather a subject specific one" (p. 722). Manno and Firestone (2008) found teacher leaders who could be considered experts in their content were better able to lead their colleagues by recognizing and correcting gaps or misconceptions in content knowledge. These teacher leaders built trust with and provided meaningful professional development for their colleagues.

Teachers' situated knowledge of mathematics content and pedagogy make them the most likely candidates to lead instructional improvement efforts within their schools (Harris & Muijs, 2005; Mangin & Stoelinga, 2008). In a study that looked at a program that intentionally invested in teacher leaders by focusing on mathematics content and pedagogy, Hopkins et al. (2013) found positive changes in relation to the overall mathematics teaching within the buildings the teacher leaders worked. These teacher

leaders, who lacked positional authority, tended to be more respected and trusted by peers. They were the people to whom the other teachers in the school went for advice regarding mathematics teaching and learning. The research of Spillane and Kim (2012) echoes this work, as they found the teacher leader often became the most prominent figure in the school's mathematics network.

Primary Teacher Leaders in Mathematics

Primary teacher leaders are teachers who teach kindergarten, first, or second grade and exhibit leadership beyond their classroom. Very little research explores the crossroads of primary teachers and teacher leadership. During an extensive search of the literature, a single study was found that specifically addressed teacher leadership of this group of teachers.

Larson and Smith (2013) reported that primary mathematics teachers displayed leadership during a school district's implementation of a new curriculum. These primary teachers, who had previously participated in an intense professional development program, contributed to the success of the implementation process by assuming teacher leadership roles. Larson and Smith provided evidence that the primary teachers in the study were active within a distributed leadership model. The teacher leaders promoted philosophies of teaching and learning mathematics that aligned with district goals and curricula, which had the potential to make a positive impact on student learning.

Professional Development

Professional development programs are systematic efforts to bring about change in the classroom practices of teachers, in their attitudes and beliefs, and in the learning outcomes of students (Guskey, 2002). Although the general idea of professional

development for improvement in education is widely accepted, research has pointed out the ineffectiveness of most programs (Cohen & Hill, 2000). Lecture-style formats are most prevalent in traditional professional development structures. Yet, there is often little transfer of new practices when using this particular format, as many times the information presented is unrelated to the current work of teachers, and follow-up after each session is missing. Therefore, apparent disconnect remains between the professional development and the current work of teachers, and little reformation takes place in the classroom. In regard to teacher change, studies indicate short-term, fragmented professional development is ineffective (National Research Council, 2001).

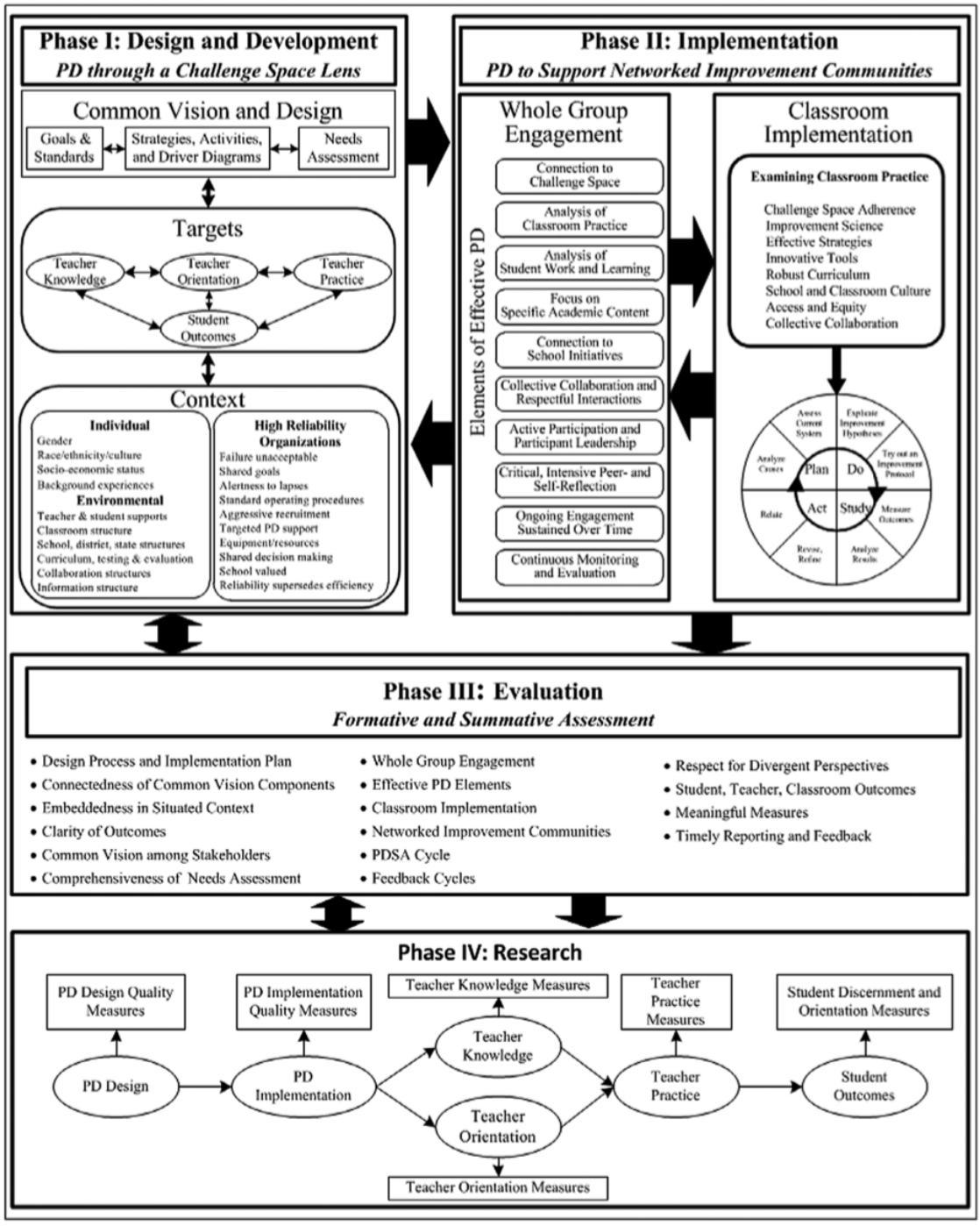
Studies identified components of effective professional development (Garet et al., 2001; Desimone, 2009; Guskey, 2002; Loucks-Horsley et al., 2010). Professional development needed to be deeply connected to the work of teachers and must have included a focus on content knowledge. The content of the session must be relevant, timely, and include information regarding the discipline of mathematics. In addition, sessions were more effective when there was collective participation of teachers (Garet et al., 2001). Therefore, it was beneficial for teachers who have similar teaching responsibilities to learn together. This way, teachers could have specific discussions regarding their use of a common curriculum or pedagogical practices (Darling-Hammond, 1997; Liberman, 1996). Another characteristic of professional development identified as highly influential for contributing to success was when the learning extended over a period of time (Garet et al., 2001). In contrast to a one-time session, changes in practice are more likely to take place when professional learning is spread over time.

Traditional forms of professional development, which fail to take qualities of effective professional development into account, have been subjected to scrutiny (Loucks-Horsley & Matsumoto, 1999). This scrutiny has been largely due to the minimal change in student achievement. Evaluators who are interested in determining the effectiveness of such professional development programs seek to find evidence of success. Often, attainment of this goal is measured by the growth in student achievement scores, which can fall short of providing a clear picture of the impact of professional development.

The PrimeD framework (Rakes et al., 2017; Saderholm et al., 2017) provides an alternative to the traditional design and evaluation methods of professional development. The PrimeD framework (see Figure 5) comprises four phases: design and development, implementation, evaluation, and research. Grounded in elements of effective professional development, the PrimeD Framework provides a structure for monitoring, evaluating, and adapting professional development efforts. While this framework is not an instructional manual, it does offer guidance to those who design, implement, and refine professional development.

Figure 5

PrimeD Framework (Rakes et al., 2017)



Leadership Professional Development

Leaders need opportunities to study and foster their own leadership. Wenner and Campbell (2017) argued it would be presumptuous to think teachers intuitively know how to lead their colleagues or schools without any type of professional development. Huggins, Lessig, and Rhodes (2017) said "good teaching does not automatically translate into skills needed to lead others" (p. 44). Leadership development must occur for teachers who do not view themselves as leaders (Huggins et al., 2017), by explicitly defining teacher leadership. A number of studies looked at how teacher leaders were prepared. Here, I present overviews of programs that have been found to foster teacher leadership.

Two university master's programs (Hunzicker, 2012; Taylor et al., 2011) that focused on teacher leadership were found to have commonalities (Wenner & Campbell, 2017). Both of these programs focused on the personal and professional growth of the teachers. Participants engaged in self-assessment and reflection, by creating a portfolio where they compiled evidence of their own learning. Additionally, the participants in each program were able to navigate their own learning by making decisions that they perceived were most impactful. Through personalizing their own learning, teachers become more familiar with themselves as learners, reflected upon the process, and shared their learning with others, which was an aspect of their future leadership roles.

During an examination of the principles of the Teacher Leadership for School Improvement degree's program, Ross et al. (2011) identified that contributed to its success. This research team found when coursework is job embedded, it is more influential for the teacher leaders. In addition, they found a focus on inquiry and reflection were key. The assignments in this program provided opportunities for practical

application related to the program's goals. Participants identified a problem of practice and spent time questioning and studying the problem. This meaningful and "real-life" work served as an important ingredient in the program's success.

Rogus (1988) developed a framework for leadership development that aligned specific leadership functions with content development. The topics included in the framework that targeted leadership were: how to work with others; creating community, empowering self and others, and articulating and communicating a vision. Other areas included concepts more directly related to teaching: effective instruction, inquiry orientation toward teaching, and fostering ownership among peers for program implementation. Finally, within the framework, there was focus on the teacher leader, to develop the personal qualities of patience and persistence. While instructional ideas were included within the framework, this study found that the inclusion of the development of being a leader was equally important.

Collaboration emerged as a key factor in a program that promotes teacher leadership. Caine and Caine (2000) and Wenner (2017) addressed the importance of having a community, or network of other professionals to learn with, as it provides support for teacher leaders. These relationships not only allow teacher leaders to see the interconnections between people and events but also helps them build a sense of empowerment and efficacy. These networks allowed teacher leaders to become acquainted with what teachers in other schools were doing, to create a common language, build connections, and foster the development and sharing of new ideas and improvement in practice (Hatch et al., 2005).

In addition to building relationships as a result of participating in a program, learning how to build relationships with colleagues and principals emerged as a key ingredient to the development of teacher leaders (LeBlanc & Shelton, 1997; Rogus, 1988; Ross et al., 2011; Silva et al., 2000). Cooper et al. (2016) also suggested teacher leaders should work on establishing trust and interacting both formally and informally with peers. A special skill set was involved in facilitating teacher learning, motivating the school community to develop, and monitoring the processes that lead to change. Katzenmeyer and Moller's (2009) findings ran parallel with the idea that teacher leaders needed time to develop skills of working with others. They argued teacher leaders need to not only understand themselves as leaders but also understand their colleagues.

Identity

Identity is the way in which an individual perceives oneself and is perceived by others (Gee, 2003). Wenger (1998) argues identity is a nexus of multi-memberships where individuals continually make sense of various roles. Luehmann (2007) calls this positioning, as how one defines their role and situates oneself in the broader culture. This shaping of identity takes time, and remains dependent on social interaction (Wenger, 1998).

A teacher must understand themselves both as teachers and as learners (Huggins et al., 2017). In a review of empirical literature, Avraamidou (2014) provides insights from research in regard to science teacher's identities. He found when teachers examined and understood themselves as teachers, experienced science as learners, engaged in reflective conversations and interactions, and attended professional development programs, their identities as teachers strengthened.

The development of one's identity as a leader is important, as becoming a leader is more than an acquisition of knowledge or skill (Paulus & Drath, 1995). Factors such as leadership vision, leadership roles, and practices, play key roles in the identity formation of leaders (Sinha & Hanuscin, 2017). A teacher's personal view in respect to teacher leadership affects their perception of their own leadership and contributes to their ongoing formation of identity (Komives et al., 2005). In a case study of teachers, Sinha and Hanuscin (2017) concluded that leadership identity becomes stronger and more well-defined as teachers successfully engage in leadership activities. The three teachers in this study did not identify as teacher leaders originally. Over time, the teachers began to recognize their own leadership capabilities due to practicing leadership in various school-based contexts. As they became conscious of their own growth, the more their identity as a leader developed (Komives et al., 2005; Sinha & Hanuscin, 2017).

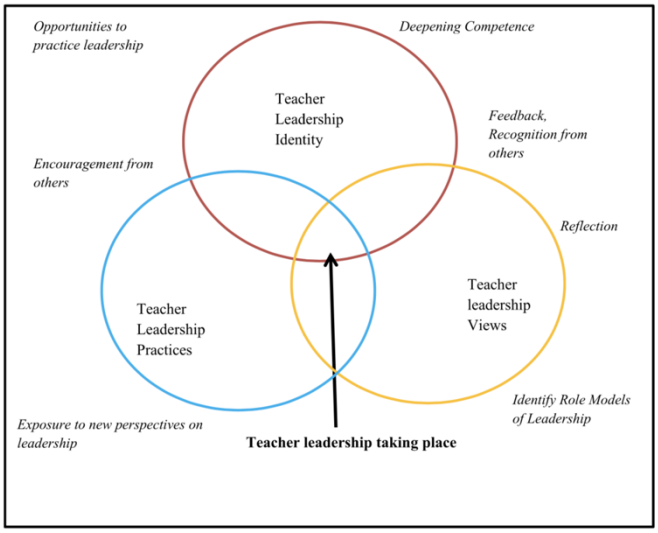
In their study, Huggins et al. (2017) found it was essential to frame teacher identity for the early career mathematics teachers with whom they were working. Within their work, they discovered this framing of identity was beneficial as it provided an explicit definition of leadership, recognized the developmental aspects of leadership, and established a sense of community among the participants. Huggins et al. (2017) formulated discussions around the National Council of Supervisors of Mathematics' (2008) *The PRIME Leadership Framework: Principles and Indicators for Mathematics Education Leaders*. This PRIME framework described leadership in mathematics education as in three parts: leadership of self, leadership of others, and leadership in the extended community. In this particular study, the researchers begin exploring indicator one with the participants: *Every teacher implements research-informed best practices and*

uses effective instructional planning and teaching strategies (NCSM, 2008). They asserted this exploration was essential in helping the teachers understand and construct their own identity as a leader, as they were able to view themselves as leaders through their work in their own classrooms. Additionally, the research team discovered the teachers in their study were able to develop further their identities as teacher leaders. The teachers accomplished this through iterative opportunities to negotiate new meanings of leadership.

Sinha and Hanuscin (2017) viewed teacher leadership as an intersection of three areas: a leader's identity, practices, and views. Sinha and Hanuscin argued that all three areas, as shown in each circle on the Venn diagram in Figure 6, must interconnect to indicate teacher leadership is taking place. The three areas are influenced by outside factors as illustrated around the circumference of the circles. Figure 6 provides a visual representation of the complexity of teacher leadership and how identity must play a role in its development.

Figure 6

Leadership Development Process (Sinha & Hanuscin, 2017)



As teachers develop identities as leaders, they adopt different views of leadership. Some teacher leaders feel leading allows them to improve their practice, learn more about content and pedagogy, and generally grow professionally (Wenner & Campbell, 2017). Ross et al. (2011) found teachers' transformed perspectives assist them as they define themselves as leaders. Teachers adopt a new view that leadership is not necessarily a formal role, but something that can be demonstrated by all and benefits everyone. In some cases, teachers are hesitant to identify themselves as leaders. Through their work, Fairman and Mackenzie (2012) uncovered that when teachers were reluctant about being regarded as leaders, they were unwilling to take on formal titles. These teachers believed a title might blur their work as a teacher leader in effecting instructional change. The development of a leadership identity is not a similar process for everyone.

Gaps in Literature on Teacher Leadership

I revealed potential gaps in the literature on teacher leadership through my literature review. Often, these gaps emerged as questions the authors specifically asked within their respective work. York-Barr and Duke (1994) asserted more research needed to be done to gather evidence of how teacher leadership impacted classroom practice and student learning. Work of this nature would provide greater insight into whether the work of teacher leaders is truly making an impact on teaching and learning.

Identity played a critical role in the development of leaders. Neumerski (2013) argued more work becomes necessary to learn how to assist teachers in conceiving of themselves as leaders and enacting leadership to support instructional improvement. While there are a number of research studies on the development of teacher leaders' identities, little existing research was found regarding identity development for teacher leaders specifically in relation to mathematics education.

As a result of two extensive literature reviews, both York-Barr and Duke (1994) and Wenner and Campbell (2017) suggested more explicit attention needs to be given to the ways in which teachers transform into the role of a teacher leaders and how professional learning can play a pivotal role in this work. They suggested one must seek greater insights into learning about what combinations of formal training and job-embedded learning best supports the development of effective teacher leaders, how professional learning for teacher leaders can be characterized, and how the learning is related to the specific contexts within which teacher leadership is enacted.

Summary

In this review of literature, I shared how teacher leadership is complex, and researchers situate their definitions within different contexts. For this study, I define a teacher leader as *a classroom teacher who takes on leadership responsibilities meant to improve pedagogical practices in their school to increase student achievement.* The work of a teacher leader differs from one teacher leader to the next; however, increased student achievement is the ultimate goal.

Teachers benefit from opportunities to identify and foster their own leadership. Although one may be a successful teacher, this success does not automatically translate into skills of a teacher leader. Effective professional development can provide experiences for teachers to not only gain more knowledge and skills but also collaborate with others and build relationships. All of these aspects of professional development contribute to a teacher's growth as a leader.

Identity is an important aspect of teacher leadership. The development of one's identity as a leader plays a critical role to the work of a teacher leader, as becoming a teacher leader is more than an acquisition of knowledge or skill. A teacher leader must understand themself as both a teacher and a leader. They must position themself by understanding this new role within the broader context, which takes time to do.

While there has been much learned about teacher leadership, gaps still exist. Researchers claim the need for more studies that examine how teacher leadership impacts classroom practice and student learning. In addition, a call emerges for gaining greater insights into how to help teachers transform into teacher leaders. Researchers seek to better understand how teacher leaders view themselves as leaders and enact their

leadership to support improved instruction and how professional development can contribute to this.

In this review of literature, I came to better understand the gaps in the area of my interest: teacher leadership in mathematics education at the primary grade level. Of the four studies that were conducted and looked at teacher leadership within the context of mathematics education, the discipline of mathematics did not play a notable role. In addition, there was only one research study that addressed teacher leadership at the intersection of mathematics and the primary grades. It was due to this shortcoming in the current literature that I sought to learn more about teacher leadership in mathematics education at the primary level.

CHAPTER THREE: METHODOLOGY

The purpose of this research study was to gain a deeper understanding of the common characteristics of teachers as they developed skills as a teacher leader, resulting from being involved in a specialized professional learning opportunity offered by a large, urban school district. The goal was gaining greater insights about teacher leadership as primary teachers of mathematics actively engaged in an intentionally designed professional learning experience. The knowledge gained from this multi-case study helped inform district leaders about the type of support teachers need as they develop teacher leadership in mathematics education. The information gained as a result of this study will be instrumental in creating professional learning opportunities in the future that work toward the goal of cultivating and sustaining teacher leaders at the primary level.

The research questions for this study are:

RQ_1: What opportunities and contextual factors do K–2 teacher leaders identify as contributing to their growth as teacher leaders in mathematics?

RQ_2: In what ways does a structured professional learning opportunity promote teacher leadership in K–2 teachers?

Researcher Positioning

I designed this qualitative study with the intent of gaining a better understanding of what contributed to the development of teacher leaders at the K–2 level in mathematics. My curiosity about this topic stemmed from a number of different interests. Early in my career, a principal encouraged me to become more involved in the school community. I joined the school improvement team, became the team leader for first

grade, and served as a curriculum liaison for the district. Following a conversation about leadership, this same principal gave me a book to read that focused on teacher leadership. This book prompted my further investigation of teacher leadership as it sparked my interest in the topic.

When I transitioned from being a classroom teacher to a leadership position as a K–2 Mathematics Coordinator, I became compelled to empower teacher leaders as my former principal did for me. The more I worked with classroom teachers from across the district who were acting as teacher leaders, the stronger my interest in the topic of teacher leadership grew. I felt fortunate to be both a participant and master teacher in a program funded by a grant from the National Science Foundation that focused on mathematics teaching in kindergarten and Grades 1–3. The coursework from this program, along with the designing of a course on leadership, pushed me to think more about teacher leadership of elementary teachers in mathematics education. Then, I was accepted into a doctoral program. My first paper for my doctoral seminar centered on the topic of teacher leadership, and this theme has continued to be woven through much of my doctoral work.

In addition to my personal interest in teacher leadership, the district in which I work restructured professional development efforts with the intent to promote leadership. With my background in mathematics education and focus on the primary grade levels, I became eager to learn how this professional development opportunity for mathematics education might promote teacher leadership at the primary level. This prompted my further exploration of this topic, as I sought to find ways to better understand teacher leadership which was directly related to my professional practice as the district's K–2 Mathematics Coordinator.

My understanding of mathematics content and pedagogy, as well as my experience as a teacher leader, brought background knowledge of the topic. During my nearly 25-year career, my work has been positioned solely within the grade span of K–2. Therefore, I understand the complexities of teaching and learning at these grade levels. My personal accounts of teacher leadership, passion for the topic, and desire to empower others as leaders were brought to this study. My knowledge of and experiences with the topic situated me as a researcher who had expertise for the study, while my genuine curiosity for the topic provided the commitment needed to execute this in-depth investigation.

I designed a study that closely examined a group of K–2 teachers from my district who participated in a professional development opportunity over the course of the 2018–2019 school year. This professional learning opportunity engaged the participants in reflecting on effective mathematics instruction and leadership. The goal for the study is to develop a deeper understanding of the factors the teachers who participated in this opportunity identified as contributing to their growth as teacher leaders, as well as how the professional learning opportunity promoted this growth.

Qualitative Design

Qualitative research seeks to "understand the world from a perspective of those living in it" (Hatch, 2002, p. 7). This type of approach is preferred when there is a need to obtain a complex, detailed understanding of an issue (Creswell & Guetterman, 2019; Creswell & Poth, 2018; Merriam & Tisdell, 2016). Qualitative researchers employ an emerging qualitative inquiry approach, gather data in the natural world (Creswell & Poth, 2018; Hatch, 2002; LeCompte & Schensul, 1999; Marshall & Rossman, 2016), and

inductively and deductively conduct analysis of the data to find common patterns or themes. These investigations are done in an effort to make sense of situations by better understanding the meanings people attach to them (Denzin & Lincoln, 2018; Merriam & Tisdell, 2016). Through this scholarly investigation I sought to better understand the shared belief of the teachers who participated in the mathematics liaison group and how they developed into teacher leaders, and a qualitative approach seemed most suitable (Creswell & Guetterman, 2019; Creswell & Poth, 2018; Merriam & Tisdell, 2016; Spradley, 1980).

Rationale for a Multi-Case Study

This study involves taking a deeper investigation of particular teachers in the context of their leadership development. A case study is favored when the central research questions answers "how" or "why," when the researcher has little control over behavioral events, and when the topic of study is a current phenomenon (Yin, 2014). Merriam and Tisdell (2016) suggested case studies provide an in-depth description and analysis of a bounded system.

This qualitative case study approach aligns with the rationale for this study, as I desired to learn more about specific cases of teacher leadership. Six individual cases were examined to explain how teacher leaders develop at the primary level. Six teachers, who had different contexts in terms of teaching and leadership, were purposefully chosen from a broader pool of teachers serving as math liaisons. My goal for the study was to gain insights into how teacher leaders at the primary level develop and what aspects of professional development contributes to this development. A multi-case study allowed me to look closely at the phenomenon of teacher leader development in mathematics

within the contexts of these teachers who taught kindergarten, first, and second grades and served as liaisons.

Interpretive Framework

Merriam and Tisdell (2016) stated, “Qualitative researchers are interested in understanding how people interpret their experiences, how they construct their worlds, and what meaning they attribute to their experiences” (p. 6). In this study, I sought to gain a better understanding of the complexity that surrounds the development of primary teacher leaders of mathematics. Therefore, I viewed myself as a social constructivist (Creswell & Poth, 2018). Individuals who subscribe to this particular theory seek to understand the world in which they live and work. The purpose of study is to describe, understand, and interpret the opportunities and contextual factors K–2 teachers identify as contributing to their growth as teacher leaders in mathematics, as well as look at how a structured professional learning opportunity promotes teacher leadership within these teachers, and my study was aligned with this epistemological perspective (Merriam & Tisdell, 2016).

Participant Selection

For this study, I used purposeful sampling (Creswell & Poth, 2018; Patton, 2002), because, as a researcher, I sought to better understand and gain deeper insights into a specific group of teachers serving as math liaisons. Participants were drawn from the 19 primary classroom teachers who were selected by their building’s administrative team to participate in a yearlong professional learning opportunity, offered by a large, urban school district, known as Math Liaisons. Principals were instructed to choose one teacher

from their kindergarten, first or second grade teachers who would embrace the learning opportunity and have the potential to share their learning with colleagues. Principals informed the teacher they selected of the obligation to represent their building in meetings across the course of the school year. Other than being positioned by their principal as potential teacher leaders, these teachers had little insight into what the professional learning opportunity entailed.

While all K–2 teachers serving as their building's math liaisons were asked to participate, each teacher indicated whether they wished to be a part of the research study. When teachers chose not to participate, their requests were honored, and their participation in the mathematics liaison group was not modified in any way. The number of liaisons who participated in the study was determined by the number of completed consent forms. Seventeen of the 19 K–2 liaisons gave consent to participate in the study.

While initially this study focused on the shared characteristics of teachers developing into teacher leaders of mathematics, focusing on a few participant's individual stories in greater depth proved to be beneficial. Fetterman (2010) refers to this as casting a big net, as the researcher learns from everyone but relies on their judgement to select members of a subculture or unit based on the inquiries of the study. Fourteen of the seventeen liaisons who gave consent to participate in the study also consented to be interviewed. I did not learn of the names of the teachers who consented to be part of the research project until after the liaison meetings had concluded.

I employed maximum variation sampling (Glaser & Strauss, 1967), so eight participants were initially contacted to be interviewed. This number was determined by categorizing teachers into two trajectories: teachers who were relatively new to

leadership in mathematics education and teachers who had some previous experience with leadership. Including both groups gave a clearer perspective of how being a math liaison contributed to a teacher's leadership, regardless of past experiences. More teachers would be interviewed from the "new to leadership" group, as this group had the potential to bring more insight into my research question. This is because the teachers in this group did not have any prior experience in mathematics education leadership and their growth may be more noticeable than a leader who had previously served as a teacher leader in mathematics.

Each of these two groups, the teachers who were new to leadership and who had previous experience with leadership, included various school demographics to provide a mixture of representation from Title I and non-Title I schools. The teachers were put into two categories of those who attended a lab day and those who did not. Liaisons were given the choice to participate in the optional lab day, a day they were released from their routine classroom duties to engage in professional development activities. Participants for the interviews were then chosen as a representation of all experiences and backgrounds.

Within the group of those who were new to leadership, four teachers were selected who attended the lab day and two teachers that did not attend the lab day. Of these four teachers who were new to leadership, four responded to the interview request. One teacher I contacted who had previous leadership experiences in mathematics education and who attended the lab day, responded to the interview request. One other teacher that fell into this same category of having previous leadership but did not attend the lab day did not respond to the interview request. To maintain a balance of participants, another liaison who had experience and attended the lab day was asked. This

person agreed to be interviewed, so in total, six teachers were interviewed as part of the study.

Limitations

Although the teachers were solely selected by their principals to participate as a mathematics liaison, there was a chance that I had worked with a participant through a prior project or district-level work. I fully understood that any previous experiences with a participant could potentially influence the findings, conclusions, and/or interpretations drawn in the research (Creswell & Poth, 2018). Therefore, I did my best to set aside any personal viewpoints to consider the different aspects of the study through a non-biased lens. I desired to perceive the phenomenon of the development of teacher leadership "freshly for the first time" (Moustakas, 1994, p. 34).

Ethical Considerations

Although the research community has developed protocols, policies, guidelines, and codes of ethics, the actual ethical practice lies on the professional integrity and methodological competence of the researcher (Merriam & Tisdell, 2016). Conducting ethically sound research involves conducting research in a way that was respectful and honest (Cohen & Crabtree, 2008). It was my intent to engage in valid and credible research, therefore complied with all written and unwritten rules of ethics as best as I could during all aspects of the study (Creswell & Poth, 2018).

In an attempt to maintain a credible and ethical study, I successfully completed the refresher course of the Human Subjects Research module of the Collaborative Institutional Training Initiative [CITI] (Human Subjects Research (HSR) – CITI

Program). It was also imperative that I gained approval from the University of Nebraska-Lincoln's Institutional Review Board [IRB] as well as the school district in which the investigation would take place. No data was collected prior to gaining approval from these governing groups.

As the researcher, I disclosed the purpose of my inquiry to participants (Creswell & Poth, 2018) in order to provide them with an understanding of my research. I reminded the participants that I did not serve in an evaluative or supervisory role. I indicated the study was strictly voluntary, as I did not want to place any undue risk on the participants. It was important the participants knew that their involvement in the mathematics liaison group did not rest upon participation in the research. In addition, all names were kept confidential, and pseudonyms were used for quotations. All identifying information that could potentially distinguish a participant, principal, or building in which one works, was omitted from the final report.

I served as the sole researcher conducting this doctoral dissertation, therefore I did not train or otherwise inform anyone regarding the data collection methods of this study. However, I anticipated there would be instances as a researcher in which it was necessary to consult with members of my doctoral committee. Consulting with university professors, who were more experienced and knowledgeable about research, provided me with the necessary information as I attempted to keep this scholarly study valid and credible.

To conduct a valid study, I attempted to provide detailed accounts of the liaisons' ideas regarding their own leadership development (Denzin, 2018; Tracy, 2010). It was my goal to provide concrete details to show, not tell (Tracy, 2010). The purpose of these

statements is to help the readers feel as if they have or could experience the events being described. Credibility is established through the lens of readers, who feel as if they could be a part of the setting or situation (Creswell & Miller, 2000). I employed a constructivist perspective to contextualize the teacher leaders who were participants in the study. By providing rich details of the liaisons and their development as teacher leaders, it is my hope that readers will find applicability in the findings to other educational settings.

Data Collection

During a qualitative study, the researcher collects descriptions of behavior, and shared characteristics through observations, interviews, documents, and artifacts (Fetterman, 2010; Hammersley & Atkinson, 1995; Spradley, 1980). The collection of case study data involves this wide array of procedures as the research strives to build an in-depth picture of the case (Creswell & Poth, 2018). Using various data sources, in contrast to just one, has the potential to provide a richer, more in-depth description. Therefore, data for this multi-case study was gathered in several ways.

Here I provide an overview of the structure of the study and how data was obtained. Data was collected over the duration of the study. Table 2 provides a list of how data were collected and the frequency of these collected data.

Table 2

Data Collection and Frequency

Data Collected	Amount
Mathematics Stories	17 mathematics stories from liaisons
Liaison Surveys (pre- and post-)	17 surveys from liaisons
Principal Surveys	4 surveys from principals
Documentation	4 professional development sessions and 2 lab days
Field Notes	following each interview, one-on-one meeting, and professional learning session
Interviews	6 semi-structured interviews
Artifacts	10 miscellaneous (email, personal conversation, etc.)

Next, I provide a general overview of how these data were collected to offer insight into how the math stories, surveys, field notes, interviews, and other artifacts were obtained and utilized.

Once approval was granted from the Internal Review Board, I sent an introductory email to participants (see Appendix B). This email was delivered during the first week of the 2018–2019 school year. Principals of the buildings in which the participants worked were copied on this email so they were aware of what was being asked of the liaison. Within this initial conversation, the participants were welcomed as a part of the unique professional learning opportunity, known as the K–2 Math Liaison

group. Specific information regarding the meeting times and expectations for participation were included so that both participants and principals were aware of what this experience encompassed. In addition, the liaisons were asked to respond to prompts regarding their personal mathematics stories.

Prior to the first liaison session in September, participants spent approximately 45 minutes documenting specific aspects of their mathematics autobiography, or personal mathematics narratives (Drake, 2006; see Appendix C). They were asked to discuss the highs, the lows, and how they viewed themselves as a teacher of mathematics. In addition, they were invited to discuss how they viewed themselves as a leader within mathematics education. The liaisons completed this assignment on their school-issued computers and submitted it to a folder specifically set up to house these stories within Google Drive. The participants only had access to their own mathematics story; however, the researcher could access each one. This assignment, completed prior to the first meeting with the math liaisons, allowed participants to reflect upon their personal journeys within a mathematics context. Not only did this assignment provide the researcher with insight into the personal reflections of each participant within a mathematics context and in regard to the perceptions of their own leadership, it also provided the participants a chance to think about their personal stories before being asked to share some of the highlights within small groups during the first meeting in September.

Participants spent approximately 15 minutes to complete a short Likert-type scale survey (see Appendix D) titled *Teacher Leadership Survey.* This survey, derived from the Teacher Leader Model Standards (Teacher Leadership Exploratory Consortium, n.d.), was used to collect initial perceptions of the teachers as leaders. I chose to utilize this

survey as it captures the many facets of teacher leadership. These are represented in Figure 7.

Figure 7

Teacher Leader Model Standards (Teacher Leadership Exploratory Consortium, retrieved from http://www.ets.org)

These seven teacher leader standards served as headings, or topics on the survey the participants completed. Under each topic, I asked various more specific questions about the topic. Here, I indicate the number of questions that fell under each broader topic.

Table 3

Teacher Leader Model Standards Survey Questions

Topic on Teacher Leader Model Standards Survey	Number of questions per topic
Fostering a collaborative culture to support educator development and student learning	5
Accessing and using research to improve practice and student learning	4
Promoting professional learning for continuous improvement	8
Facilitating improvements in instruction and student learning	6
Promoting the use of assessments and data for school and district improvement	4
Improving outreach and collaboration with families and community	5
Advocating for student learning and the profession	5

Participants completed a total of 37 questions on the Teacher Leader Survey by choosing the response that they felt best represented their leadership at that time. This questionnaire used a psychometric scale (Devellis, 1991) that had five possible responses. The scale given was Not at All (1), Moderate Extent (3), to Great Extent (5). Participants used this rating scale to indicate their current perceptions of their own leadership in mathematics education at that given time. All teachers participating in the math liaison

group were asked to complete this survey; however, I only analyzed the responses from those with signed consent forms (see Appendix E).

The building principals who had math liaisons consent to participate in the study, received a letter that outlined the study (see Appendix F). A consent form was included (see Appendix G) as well as a principal survey (see Appendix H). The survey sent to the principals of liaisons who consented was almost identical to the survey that was administered to the teacher participants; the only difference was that the principal survey was intentionally titled *Principal Survey* to differentiate this survey from the teacher leaders' surveys during the data analysis process of the study. While the teachers in the mathematics liaison group completed the survey thinking about their own leadership, the principals completed the survey in regard to their perceptions of the particular teacher's leadership who was serving as their building math liaison. Principals were asked to return the consent form and surveys to my doctoral advisor in a self-addressed envelope by a specific date. A reminder email was sent to the principals who did not turn in the survey as initially requested (see Appendix F). My advisor kept the consent forms in her possession until after the final math liaison meeting. Only the data from those principals who signed the consent form was used in the analysis.

During the liaison meetings, as well as during the classroom collaborations, I made observations regarding participant behavior and actions in relation to leadership. Immersion is a characteristic of qualitative research, where a researcher positions themself in the physical context of the study and directly interacts with participants. Thus, the researcher plays a central role in the investigation and can be considered as a prime instrument (Creswell & Poth, 2018; Merriam & Tisdell, 2016). These observations

provided a “first-hand encounter with the phenomenon of interest rather than a second-hand account of the world obtained in an interview” (Merriam & Tisdell, 2016, p. 137). Data collection through observing was an important contribution, as by taking an active role, I explored the complexity of the issue and became aware of any other factors that contributed to the findings (Creswell & Poth, 2018). Notes from the observations made during my interactions with the participants were kept in a journal, along with any further questions or wonderings that surfaced as a result of the observations.

At the last math liaison meeting in March, participants were given a final assignment. The teachers were asked to add to the personal mathematics story they completed prior to the first meeting. This final assignment provided the teachers time to reflect upon the professional learning experience and communicate any feelings that may have changed as a result of the math liaison opportunity. These personal mathematics story additions were housed in the same folder in Google Drive as the original submissions. Liaisons were also asked to complete the *Teacher Leadership Survey* one more time, using their current reality as context.

Anticipating there would be different factors contributing to the teacher leaders’ development, I sensed there might be common characteristics as well. To gain a greater insight into these factors that influenced the teacher leadership growth within the K–2 liaisons, I interviewed a limited number of teachers. Interviews serve as “a construction site of knowledge” (Kvale, 1996, p. 2) where “a theme of mutual interest” is discussed (Kvale & Brinkmann, 2009, p 2). Interviews are a very important source for data collection when conducting case studies (Yin, 2014). By conducting person-to-person

interviews, I gained more insight into teachers' feelings and thoughts regarding their leadership development in mathematics education.

To maintain consistency among interviews, a semi-structured interview protocol was used (see Appendix I). I developed this protocol based on my research questions and conceptual framework. This format allowed for flexibility within the interview and provided opportunities for me to respond or ask follow-up questions when necessary (Merriam & Tisdell, 2016). The list of pre-generated questions was shared with the participants in advance by email (see Appendix J) so they were able to have a sense of the purpose of the discussion and get an overview of what they would be asked. The interviews were held at the convenience of each participant in a location of their choice and were captured on an audio recording device for transcription. Upon completion of this dissertation research, the files of the audio recordings and transcriptions will remain on the researcher's personal computer, protected by a personal password, and destroyed after three years.

I expected additional artifacts would be gathered throughout the study. These IRB approved artifacts included but were not limited to: correspondence through emails, personal communication with liaisons, and comments made by other teachers in the building regarding the participant's leadership. Other documents teachers provided from their work as a leader were also collected. These pieces of "everyday living" (Merriam & Tisdell, 2016, p. 171), were added to the other data in an attempt to provide the richest description possible. Thoughts regarding these additional artifacts were kept on written memos, which were analyzed during the analysis phase of the study.

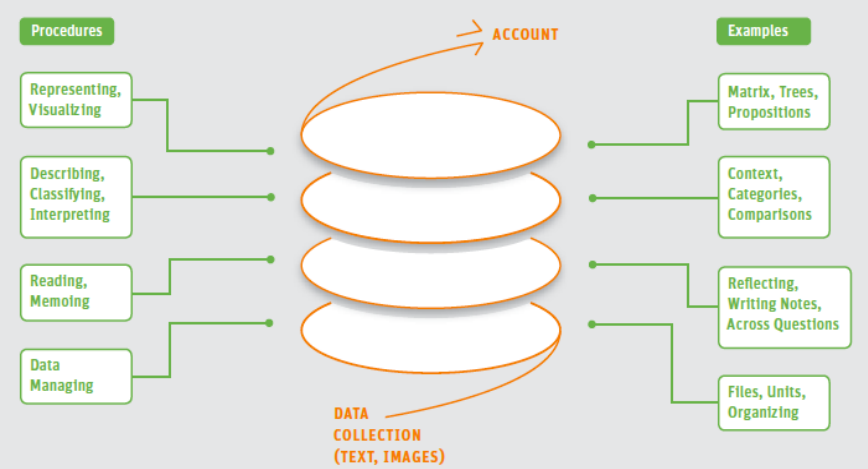
For purposes of this study, I collected data through personal mathematics stories, surveys, and interviews. In addition, I gathered artifacts and documentation. The use of multiple data sources allowed for triangulation of the data throughout my analysis.

Data Analysis

Knowing data analysis is not a prescribed method (Creswell & Poth, 2018), I anticipated the process to be one that would be customized to my study. In a qualitative study, data collection and analysis occur simultaneously (Creswell & Poth, 2018; Merriam & Tisdell, 2016). Dey (1993) illustrates this process by a spiral image in opposition to a lock-step linear approach (see Figure 8). This graphic depicts the cyclical process I utilized for data analysis during this study. I simultaneously collected and analyzed data, which began directly following the first liaison meeting. This process continued throughout the liaison experience through when the last interview was conducted. Once data were collected, I analyzed it, wrote memos to myself, and spent time classifying and interpreting the data.

Figure 8

Concurrent Data Collection and Analysis (Dey, 1993 p. 6)



Memos

As part of this ongoing process, I purposefully wrote notes, or memos, to myself (Corbin & Strauss, 2008). Yin (2014) believes these notes contain hints, clues, and/or suggestions that attempt to put any preliminary data interpretation into a written form. Following the receipt of the personal mathematics stories, I read through each story and wrote a memo to summarize my thoughts. In addition to this initial memo, I took 30 minutes following each liaison meeting to record my thoughts in regard to the meeting in a similar fashion. Following each lab day, I also wrote a memo.

Part of the expectation for math liaisons was to meet with a district-level coach. During these meetings, which were held in the liaisons' classrooms, I intentionally did not take notes but rather remained present in the conversation. The topic of the discussions during these one-on-one meetings remained at the discretion of the liaison. Each liaison chose what they wanted to discuss in respect to the teaching practice on

which they had chosen to focus. Directly following each meeting, I wrote a brief memo to summarize the essence of the conversations.

Throughout the study, I gathered artifacts and brought insights to answering the research questions. These artifacts included: emails from liaisons, PowerPoint slides liaisons developed to present with their staff, and resources liaisons shared with other staff members. Following the last liaison meeting, I analyzed the artifacts. A memo was written to summarize the themes that emerged from these articles collected during the duration of the data collection process.

Through these memos, I captured any and all ideas I sensed were important to answering my research questions. I developed "hunches," or found ways to make sense of the data, (Merriam & Tisdell, 2016) through the process. The more data that were gathered, I utilized as I searched for patterns, insights, or concepts that seemed to have potential (Marshall & Rossman, 2016). These patterns, insights, and concepts became springboards for further analysis.

Surveys

Once the pre- and post-surveys were completed, I analyzed the data from these two instruments. Then, I tabulated the individual responses from the liaison's surveys. Each liaison's response for every question was compiled on a blank survey. Each liaison was assigned a letter of the alphabet, A through Q, to indicate individual responses. I recorded responses on a spreadsheet by their assigned letter. I replicated the same process for post-surveys on a separate spreadsheet.

After the compilations of data were complete, I compared the two sets of data. This process was done by indicating if individual liaison's responses had shown an

increase, decrease, or remained the same. This data was compiled into a graph using Excel to reveal any trends that may have occurred from the pre-survey to the post-survey.

Responses from the principal surveys were not analyzed, due to a low return rate of the surveys. Less than 25% of the surveys were completed, as only four of the 17 principal surveys were returned. Of these four principal surveys I received, two were from the principals of the six teachers who were interviewed. Due to the limited amount of data obtained from these four surveys, I felt the data would not be sufficient in drawing conclusions. Therefore, the data from the principal surveys was not analyzed as part of the data analysis process.

Interviews

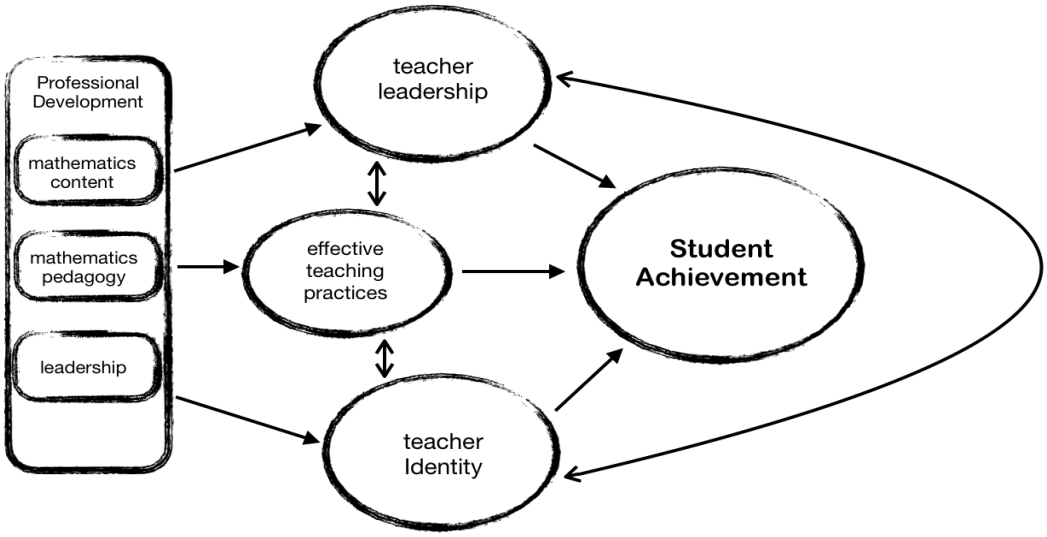
Following the interviews with each of the six liaisons, I transcribed the separate audio-recordings. This transcription took place through a digital tool, Temi (www.temi.com). Transcriptions were initially in a rough form; however, necessary edits were made so the meaning was not lost. An exact transcription of the interviews was not necessary to extract certain phrases or themes. As these data from the interviews were transcribed, they were "processed" (Marshall & Rossman, 2016, p. 208). This act entailed judgment and interpretation. It was important to make sense of the transcription, so reading the entire interview multiple times occurred. Once I gained a good understanding of the interview, I began to search for and note all key ideas. Then, as Bogdan and Biklen (2007) described, I considered any themes that emerged and took time to consider how these ideas related to the broader topic under study. These ideas were summarized in a memo. I wrote six memos, one for each interview of the six math liaisons who were a part of the focus group.

Coding

Once all memos from the interviews, surveys, and other artifacts were complete, I began the process of coding. Coding involves aggregating the data into small categories of information. Creswell and Poth (2018) suggest to begin with a short list of five or six categories or codes as a larger number of codes may prove to be too complex. My conceptual framework served as a tool to assist in my analysis, as it provided a foundation to begin analyzing the data as I worked to understand, to explain, and support the results of the study (Eisenhart, 1991). Each topic embedded within my conceptual framework served as an initial code. These a priori codes (Crabtree & Miller, 1992) assisted in the data analysis process from initially being too complex. Here, I explain how I used the conceptual framework to refine my analysis (see Figure 9).

Figure 9

Conceptual Framework



To begin, I used theory-generated codes from my conceptual framework that were derived from the literature review (Marshall & Rossman, 2016). A priori codes were:

- PD-MC: Professional Development-Mathematics Content
- PD-MP: Professional Development-Mathematics Pedagogy
- PD-L: Professional Development-Leadership
- TL: Teacher Leadership
- ETP: Effective Teaching Practices
- I: Identity
- SA: Student Achievement

In addition to the list of a priori codes as shown above, I included a code to capture themes related to the overall experience of being a liaison. I indicated this code as ML: Math Liaison Experience. Each code was given a specific acronym to assist in the coding process, which is listed prior to each code above.

I developed a code book (see Appendix K) as it was essential for me to define each code. This code book served as a point of reference for others who participated in the data analysis process to establish reliability. Each code had its own unique description. The descriptions for each code are described in Table 4.

While the initial codes initiated by my conceptual framework gave me a place to begin my analysis, I anticipated there would be numerous data that fell under a few of the codes. Therefore, subsidiary codes emerged. Within Teacher Leadership (TL), three sub-codes became necessary: roles, beliefs, and opportunities. These were recognized as TL-R (roles), TL-B (beliefs), and TL-O (opportunities). By using these sub-codes within the larger category of teacher leadership, I felt I could gain a better understanding of the

different components with teacher leadership. I added the sub-codes teacher, leader, and learner under identity. I recorded the codes as I-T for teacher, I-LD for leader, and I-LR for learner. Having three sub-codes allowed me to separate the different components of one's identity.

Table 4

Code Descriptions

Code	Code Full Name	Code Full Description
PD-MC	Professional Development-Mathematics Content	Refers to both formal and informal, as well as district and building, professional learning that is related to mathematical content. Also includes learning opportunities outside of the district that involves learning about mathematical topics. These opportunities allow for teachers to gain knowledge related to mathematical concepts and ideas.
PD-MP	Professional Development-Mathematics Pedagogy	Refers to both formal and informal, as well as district and building, professional learning that is related to teaching mathematics. Also includes learning opportunities outside of the district that are targeted to improve instruction. Topics related to effective instruction can be such as mathematical discourse, using mathematical tools and representations, productive struggle, mathematical goals/objectives, problem solving, high quality tasks, questioning, assessment, conceptual understanding, and procedural fluency.
PD-L	Professional Development-Leadership	Refers to professional learning that contributes to improving leadership skills. This could be formal opportunities to study leadership or informal opportunities where teachers gain new knowledge about aspects of leadership through interactions with others such as building or

		district administrators or through leadership experiences.
TL	Teacher Leadership	*Roles (TL-R) Refers to formal roles of teacher leadership, such as serving as a team leader. Also includes informal roles of teacher leadership, such as mentoring, where a teacher exercises leadership. Includes the actions of the teacher in a leadership role and influences on others. *Beliefs (TL-B) This includes perceptions and beliefs (positive and/or negative) about teacher leadership as well as leadership opportunities presented to a teacher by another person or group. *Opportunities (TL-O) Include how others may influence one's teacher leadership as well as how individuals seek opportunities for leadership.
ETP	Effective Teaching Practices	Refers to aspects of research-informed instructional practices for mathematics in relation to the classroom. This includes beliefs and attitudes about instruction and learning mathematics. Involves topics related to effective instruction such as mathematical discourse, using mathematical tools and representations, productive struggle, mathematical goals/objectives, problem solving, high quality tasks, questioning, assessment, conceptual understanding, and procedural fluency.
TI	Identity	*Teacher Identity (I-T) Refers to how a teacher views himself or herself in relation to the profession. This may include beliefs or attitudes about how the teacher feels about himself/herself as a teacher. Includes perceptions of how a teacher characterizes oneself as a professional, views themselves in a positive way, as well as how they may view

		themselves in terms of missing, lacking or needed skills. *Leader Identity (I-LD) Refers to how a teacher views himself or herself in relation to leadership. This may include beliefs or attitudes about how the teacher feels about themselves as a leader. Includes perceptions of how a teacher characterizes oneself as a leader, views themselves in a positive way, as well as how they may view themselves in terms of missing, lacking or needed skills. *Learner Identity (I-LR) Refers to how a teacher views himself or herself as a learner. This may include beliefs or attitudes about how the teacher feels about himself/herself as a learner. Includes perceptions of how a teacher characterizes oneself as a learner, views themselves in a positive way, as well as how they may view themselves in terms of missing, lacking or needed skills.
SA	Student Achievement	Refers to student learning in mathematics. Also includes beliefs, either positive or negative, about student learning and achievement in mathematics. Involves references to data that may indicate a trend in student learning.
ML	Math Liaison Experience	Refers to the experience of being a math liaison. Also the structure of the liaison meetings, agenda of the meetings, and opportunities in which liaisons may have interacted with other liaisons. Includes lab day experiences and interactions with a liaison facilitator. Both positive and negative aspects of the liaison experience are included.

Coding Process

The process of coding has the potential to become a sizable task without the use of an organizational tool. A digital tool, Dedoose (www.dedoose.com), was used to aid

with the coding process. Then, I uploaded each interview transcript and memo to the Dedoose website. Dedoose is available through a paid subscription and is password protected.

Dedoose has features that allow interview transcriptions and memos to be coded directly within the digital software. Once I coded the data in the system, Dedoose had features that allowed the data to be sorted by each code. This system became a useful organizational tool to locate big ideas and themes.

Reliability in Coding

I needed to ensure reliability in the coding process. In an attempt to do this, I invited a colleague to code at least 10% of the data that was collected for the study, which consisted of two interviews. I shared the codebook to the colleague in advance so she could become familiar with each of the different codes. Then, my colleague and I engaged in a discussion about any questions she had about the codebook. Together, we coded the first page of an interview to verify we were interpreting the codes in a similar way. Next, my colleague coded the rest of the interview on her own while I did the same. During this time, we did not have any conversations regarding the data or coding process. Once we were finished coding the entire interview, we met to reconcile our codes until we had 100% agreement (Creswell & Poth, 2018). The coding process, coding the two interviews independently and then coming back to reconcile, provided evidence that the coding results had inter-rater reliability.

After coding the two interviews and reconciling the results with a colleague, I independently coded the other four interviews and all memos. Following the completion of this process, the coding became more refined. This process, shown in Figure 10

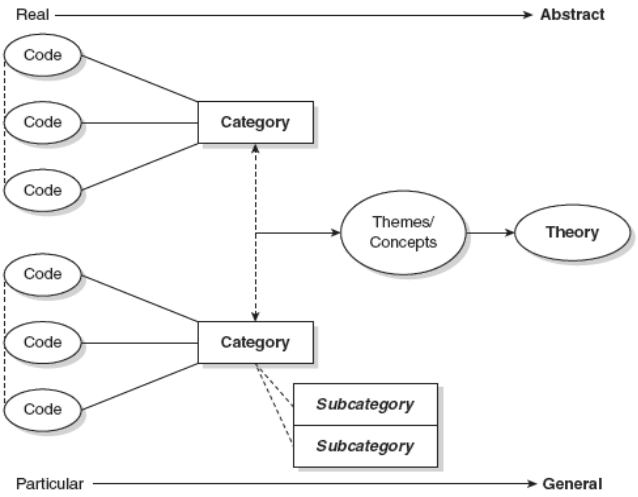
(Saldana, 2008, p. 12), provides a visual representation of how the analysis becomes more interpretive. I moved from initial coding to "axial coding" (Corbin & Strauss, 2008; Marshall & Rossman, 2016), where categories emerged from interpretation and reflection of meaning (Richards, 2005). As a part of this process, I took each separately coded interview transcription and memo and summarized the findings. I used a two-column organizer. On the left-hand side of the organizer, I noted the excerpts from the transcript that were most important for gaining knowledge about my research question. Directly across from each excerpt in the right-hand column, I recorded my thoughts about the expert as I tried to make sense of what the teacher leader's comment was about. When I was finished, I had a summary of the interview and memos as well as my interpretation in one document.

I applied the process of axial coding to the list of excerpts that were categorized by codes. The Dedoose program has the capability of creating a list of data based on each code. I used the same two-column organizer that resulted in a summary of the codes that was paired with my interpretations. This process allowed me to distill the most important aspects from each code, which was beneficial as I moved into the last phase of coding. Any code that did not appear more than three times in the initial coding process was not used as a part of the analysis.

Once I determined axial codes, I used "selective coding" (Merriam & Tisdell, 2016, p. 229) to develop core categories. Yin (2014) describes this process as "working from the ground up" (p. 135), which allowed me to reach the position of where major themes and patterns emerged and provide insights into my research questions.

Figure 10

Coding Process (Saldana, 2008, p. 12)



Within the data analysis process, a researcher must employ specific techniques to develop internal and external validity. *Explanation building* (Yin, 2014) happens when the researcher "analyzes the case study data by building an explanation about the case" (p. 147). As memos were written and codes were developed and analyzed, I went back to my research questions:

> *RQ_1: What opportunities and contextual factors do K–2 teacher leaders identify as contributing to their growth as teacher leaders in mathematics?*
>
> *RQ_2: In what ways does a structured professional learning opportunity promote teacher leadership in K–2 teachers?*

My research questions drove this process, as it kept me focused on developing codes that would help me find answers to my investigation. I had the opportunity to revisit initial theories and make comparisons to other details of the case. It was my intent to make any necessary revisions by replicating this process as needed. This iterative nature of building

an explanation (Yin, 2014) allowed me to make refinements in order to reach theoretical saturation (Marshall & Rossman, 2016).

While Merriam and Tisdell (2016) suggest it is difficult to capture the absolute "truth" with a qualitative method, particular strategies increase the integrity of the research. During this study, I remained mindful of reliability and validity during the collection, analysis, and integration of data. Triangulation of data assisted the research in asserting the data interpretations are credible (Marshall & Rossman, 2016).

CHAPTER FOUR: PROFESSIONAL DEVELOPMENT AND PARTICIPANTS' CONTEXTS

In this chapter, I describe the professional development sessions that took place as a part of the mathematics liaison experience. Descriptions of each of the four professional development sessions will be shared to provide an overview of the entire experience. In addition to the four sessions, the optional lab day is discussed. I will also speak to the one-on-one meetings that math liaisons were expected to participate in. This chapter presents an overall picture of the professional development experiences liaisons engaged in over the course of the 2018–2019 school year.

At the end of Chapter 4, I offer a brief description of the liaisons who participated in this study. These classroom teachers, who served as their building's K–2 mathematics liaison, were purposefully chosen based on their past leadership experience and varied participation in the optional lab day. Chapter 4 provides a general insight into each of the liaisons who participated in the study; however, I will elaborate on the stories of these liaisons in Chapter 5 in relation to the context of the research questions.

Math Liaison Experience

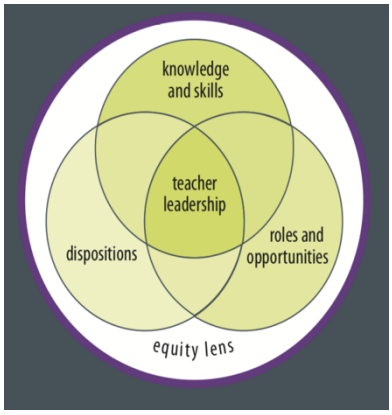
The mathematics liaison group met as a large group four times across the 2018–2019 school year. These meetings took place in September, November, January, and March. Liaisons met at the district's professional learning center from 4:15 p.m. to 6 p.m. each time. Two optional lab days took place in February. In total, 39 elementary classroom teachers served as a liaison for their respective buildings. Twenty of the liaisons taught in the intermediate grades, Grades 3, 4, or 5. The other 19 teachers taught

at the primary grade level, in Grades kindergarten, 1 or 2. Two district-level coordinators served as the facilitators of this group. I was one of these two facilitators.

The goal of professional development was to provide math liaisons with experiences and opportunities to think more deeply about effective mathematics instruction as well as leadership in mathematics education. I used the Teacher Leadership Skills Framework (CSTP, 2018) as a framework for the design of each meeting and lab day. Intentional decisions were made regarding the content of each meeting and lab day, each having a focus on one of the areas in the framework. Over the course of the liaison experience, the liaisons engaged in tasks that address roles and opportunities, knowledge and skills, dispositions, with the hope that by thinking more deeply about these aspects the liaison would develop in the area of teacher leadership.

Figure 11

Teacher Leadership Skills Framework (CSTP, 2018)



Resources regarding effective teaching practices were utilized. Here, the four liaison meetings are described to provide an in-depth overview of each meeting.

Liaison Meeting #1: September 2018 (see Appendix L)

Another district-level math coordinator and I facilitated the first liaison meeting. After the liaisons were welcomed, we shared a brief overview of the structure of the role of math liaisons. It was important to clearly communicate there would be a shift from the traditional "messenger model" to that of providing professional development to their colleagues. Rather than obtaining information about mathematics instruction from district leaders and relaying it to colleagues in their respective buildings, liaisons would now be engaging in professional development activities. Many liaisons were not familiar with the new format, so we answered questions regarding the change.

My doctoral advisor attended this meeting and addressed the liaison group. During this time, I exited the room. It was important that as a researcher, I was not present when the math liaisons signed consent forms and completed the teacher leader surveys. My advisor provided an overview of the research study and distributed teacher consent forms (see Appendix E) and teacher leader surveys. She remained in the room while teachers completed the consent forms and surveys. The advisor took the completed documents with her as she exited the room.

Next, liaisons engaged in a cooperative activity. This activity was designed for liaisons to connect with other liaisons they may not have known as well. The time also allowed the liaisons to reflect upon common characteristics of their personal mathematics stories. To begin, liaisons moved around the room to music and convened in groups of four once the music stopped. Groups were given a total of four minutes to talk. Each member of the group described their experience as a learner of mathematics in elementary, middle, and high school, speaking for one minute. After the first person

finished, the second person began when they heard an auditory signal. This process continued until all four people in the group had an opportunity to share. Next, the liaisons moved into groups of three. At this time, each liaison was given two and a half minutes to speak to their "high" as a learner of mathematics. To end this activity, liaisons gathered in groups of two. During a one-and-a-half-minute time period, each person described a "low" as a learner of mathematics. Following this activity, liaisons returned to their seats, reflected upon and responded to the prompt: *How did what you said and heard about learning mathematics make you think about teaching mathematics?* Liaisons wrote their responses to the prompts on a large Post-it note and placed the notes inside the cover of the free book they received from the district, *Principles to Actions: Ensuring Mathematical Success for All* (NCTM, 2014). Each liaison took a digital photo of their response and uploaded it to a folder in Google.

Once the liaisons completed their response, the facilitators shared the Teacher Leadership Skills Framework (see Figure 11) with the liaisons. This conceptual framework provided guidance as the facilitators of the liaison group determined what activities liaisons would engage in during large group meetings as well as when they met one-on-one with a district math coordinator. During this discussion, participants learned that the intent of the liaison experience was to promote professional growth. The focus was on growing the liaison's knowledge of mathematics, in both content and pedagogy. As a result, the goal was to strengthen the liaison's dispositions toward mathematics. When knowledge and skills are coupled with dispositions and roles and opportunities, chances for teacher leadership can emerge. All of these ideas are housed within equity, as the goal is to provide high-quality learning experiences for all learners. Liaisons reflected

upon and processed their understanding of this conceptual framework with the other teachers sitting at their table.

Following the discussion about the conceptual framework that was used to structure the liaison experience, the discussion shifted to district expectations for liaisons. Liaisons learned about the structure of experiences, as well as what was expected of each participant. To meet the nine-hour requirement set by the district, the 2018–2019 math liaisons had four one-and-a-half hour meetings. Three additional hours would be met through one-on-one meetings with a district-level mathematics coach and through time spent reading professionally. It was important the liaisons understood this new structure, as it was designed to empower potential teacher leaders of mathematics. Principals selected each participant to serve in this capacity, as they felt their building representative had the potential to be an influencer in mathematics.

Liaisons read an excerpt from *Principles to Actions: Ensuring Mathematical Success for All* (NCTM, 2014). They read pages 99–106 and highlighted parts of the text that they felt spoke to them. This section, titled Professionalism, outlined important aspects to consider as a teacher of mathematics. Once everyone read the assigned pages, the liaisons formed small groups. A structure was given to provide opportunities for each person in the group to share. In a round robin fashion, each liaison shared one thing they highlighted. We instructed liaisons to not respond to one another's thoughts until everyone had the chance to speak. Once every person in the group was able to share, the group could respond to one another and discuss connections about the parts, or sections, they found interesting. To conclude this activity, liaisons participated in a large group

conversation that focused on a particular excerpt from the reading that addressed professional development in mathematics.

At the conclusion of the meeting, the facilitators gave the liaisons an assignment to complete prior to the second meeting. The facilitators asked liaisons to read pages 7-57 of *Principles to Actions: Ensuring Mathematical Success for All* (NCTM, 2014). This section describes the eight effective teaching practices for mathematics. Before everyone was dismissed, the facilitators addressed any last-minute questions regarding the new structure of the liaison experience.

Liaison Meeting #2: November 2018 (see Appendix M)

The meeting facilitators greeted the liaison and engaged them in a problem-solving activity. A picture of a hotel bellhop was displayed to begin the activity. Liaisons drew upon their background knowledge to think about the duties of a bellhop. Then the problem was posed: *Three men check into a hotel and take a room for $30, with each paying $10. Later the room clerk notices that the charge for the room should only have been $25, so he gives the bellhop $5 and tells him to return it to the three men. To make arithmetic easier, the bellhop keeps $2 and gives each of the three men $1 each. Originally, the men had paid $10 for the room but now that they each got $1 back, each of them paid only $9 for the room. 3 x $9 is $27 plus $2 the bellhop kept is $29. What happened to the other dollar?*

After liaisons had some time to work on the problem independently, they discussed their thinking with a neighbor. This discussion continued, as one of the meeting facilitators captured digital images of three liaison's work. The group discussed the digital images, which were intentionally chosen. At the conclusion of the discussion, the

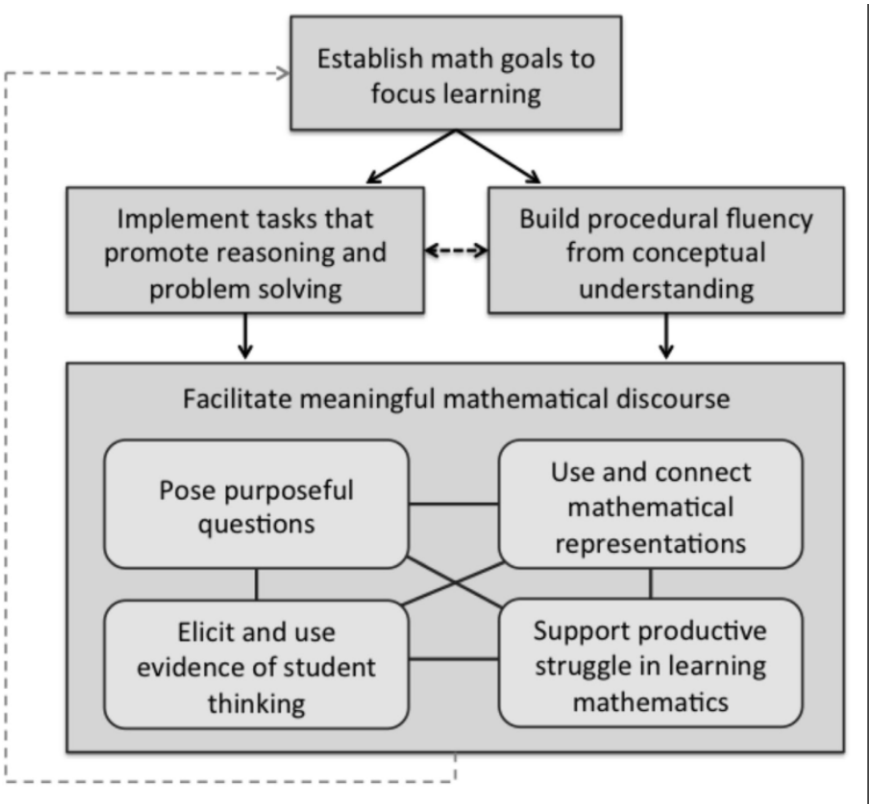
group had a collective understanding that the three men each paid nine dollars for the room, and a bit more for the two dollars (or tip) the bellhop received. Liaisons spent time reflecting upon the process of solving the problem in small groups. They were also asked to pinpoint aspects of effective teaching practices for mathematics they had just experienced by providing evidence. Liaisons spoke to how having a discussion helped deepen their understanding of the mathematical situation. The intent of this activity was to encourage liaisons to reflect upon effective teaching practices and think about which aspects they might want to learn more about.

Next, the group revisited the conceptual framework that was shared during the first meeting. Facilitators shared that teachers of mathematics continue to deepen their mathematical knowledge for teaching throughout their careers. This idea would be a springboard for the next activity liaisons would engage in. The meeting facilitators introduced the activity as professionals seek to learn and grow, referring back to the excerpt on professionalism that liaisons read during the previous meeting. Each liaison received an enlarged sheet that included continuums for each of NCTM's eight effective teaching practices (see Appendix N). On the left side of a continuum was a description of no evidence of the effective teaching practice, while on the right side of the continuum was a description of full implementation of the effective teaching practice. Liaisons engaged in self-reflection, by placing an X on the continuum where they felt they were in regard to each effective teaching practice. Once each liaison completed this task, the meeting facilitators discussed how each liaison would choose one from four effective teaching practices to focus on. These four effective teaching practices were: support productive struggle in learning mathematics; use and connect multiple representations;

pose purposeful questions; and elicit and use student thinking. This decision was made with a purpose, as the four targeted effective teaching practices fell within the realm of facilitating meaningful mathematical discourse (Huinker & Bill 2017). Figure 12 provides a visual image of this framework and shows how the four effective teaching strategies the liaisons could choose from are related to the other teaching practices. Once the four focus teaching practices were identified, liaisons returned to their self-reflection to choose which of the four practices they would like to focus.

Figure 12

Teaching Framework for Mathematics (Huinker & Bill, 2018, p. 245)



Because professionals do not work in isolation (NCTM, 2014), liaisons gathered into four groups in different corners of the room. Each group had a specific teaching practice as a focus. The group was asked to come to a shared understanding of the teaching practice. Groups had approximately 20 minutes to discuss the section from *Principles to Actions: Ensuring Mathematical Success for All* (NCTM, 2014). Next, individual liaisons were asked to determine which aspects of the practice they wanted to initially focus on for their own professional growth and write it down on a Post-it note. To encourage the liaisons to think more deeply about this practice, they considered their current reality with respect to their newly formed goal. Then, they identified two or three concrete things they could do realistically, and committed to one with the goal of making a shift on the continuum over the course of the year. This "call to action" encouraged the liaisons to think more deeply about their own practice and aspects they wanted to refine. In addition, each group discussed how they could support one another as they engage in this work.

The last part of the meeting focused on the expectations of the one-on-one meetings liaisons would have with district-level coordinators. The goal of this time was to communicate that professional relationships can support and sustain one's learning. Facilitators shared options for support from district-level coordinators through a Menu of Support for Effective Teaching Practices (see Appendix O). Liaisons were informed that these were options for their individual work with a district-level coordinator. Each liaison completed a Support Request Form (see Appendix P) and the information from the forms assisted in organizing one-on-one meetings.

To conclude this second meeting, each liaison received a copy of *Taking Action: Implementing Effective Mathematics Teaching Practices in K–Grade 5* (Huinker & Bill, 2017). Liaisons would use this book during the liaison experience and could keep this resource. The facilitators asked liaisons to read the chapter that corresponded with the teaching practice they selected. Following discussion of the assignment, the facilitators answered questions to clarify the expectations of liaisons. As an exit ticket, each liaison reflected upon the mathematics liaison experience thus far. This information guided the planning of the last two meetings.

Liaison Meeting #3: January 2019 (see Appendix Q)

To begin the January meeting, district-level facilitators provided a quick recap of the activities from the second meeting where liaisons engaged in self-reflection and determined which effective teaching practice on which they wanted to focus. Next, liaisons reconvened into the same small groups as they met in during November's meeting. These small groups revisited the practice they chose to focus on and discussed the content they read from *Taking Action: Implementing Effective Mathematics Teaching Practices* (Huinker & Bill, 2017). After approximately 20 minutes of discussing the chapter, liaisons shared progress they made with respect to the goal they previously determined. Liaisons determined their next steps. Then, they reflected upon the question, *How will this community (liaisons) continue to support you?*

Bridging to the next activity, liaisons revisited the conceptual framework. District-level facilitators reminded the group they had been focusing on knowledge and skills. The facilitators shared the idea that teacher leadership includes roles and

opportunities. This idea led the liaisons into the next activity, which focused on leadership.

Facilitators displayed seven sheets of paper on the board prior to the activity. Each paper was distinctly labeled with different opportunities for leadership in mathematics: personal, classroom, grade level, building, district, state, and national. The large group engaged in a discussion that leadership can be housed within each of these contexts. Facilitators offered a few examples and placed them upon the appropriate sheet related to the level of leadership. For example, reviewing assessments for the mathematics curriculum department is an example of leadership at the district level. Making refinements to one's own instruction is leadership at the classroom level. Following a few examples, table groups brainstormed other possible leadership opportunities in mathematics education. Following this small group conversation, the large group reconvened. All liaisons engaged in a conversation, as small groups shared the ideas they generated. (This list was copied and shared with liaisons following the meeting; see Appendix R). To conclude this conversation, the meeting facilitators summarized leadership in mathematics education has many forms, leadership can take place in various spaces, and opportunities for leadership in mathematics education are abundant. Liaisons were encouraged to set a personal goal for leadership growth and move toward more public/formal leadership roles.

The liaison group revisited the conceptual framework. Liaisons noticed how equity encompasses the aspects of teacher leadership. Then, facilitators shared information about the optional lab day. Each liaison could participate in a lab day if they wished. The lab day would dive deeper into the effective teaching practices and focus on

equity within mathematics. Details were shared regarding the lab day and liaisons were given approximately a week to indicate their interest. It is important to note the district determined the lab day would be optional for the math liaisons, as funding was not secured prior to when the liaisons agreed to participate as a math liaison. The district did not feel it could require the liaisons to have to develop plans for substitutes and be out of their classrooms if they did not know about this prior to the beginning of the experience.

To prepare for the final meeting in March, liaisons reflected upon their learning journeys. They were invited to dedicate time and thought to their effective teaching practice and leadership goal. The facilitators answered questions and dismissed the group.

Liaison Meeting #4: March 2019

The final meeting included reflection and celebration. There was not a formal presentation, but rather liaisons engaged in a few short tasks. Upon entering the room, the facilitators welcomed liaisons with a table of snacks and congratulatory notes such as "You did it!" and "You are amazing!" The district-level facilitators wanted to create an atmosphere that celebrated the time and effort the liaisons expended to nudge themselves in teaching mathematics and leadership.

First, each liaison completed a Google Form (see Appendix S) that encouraged them to think about their own personal experience. The meeting facilitators allocated approximately 15 minutes to completing this form. Once the form was complete, liaisons revisited their personal mathematics story they wrote prior to the first meeting and added relevant comments about their journey as a math liaison.

Next, all 39 liaisons engaged in a roundtable discussion. The facilitators audio-recorded the discussion to capture the big ideas while remaining fully present in the conversation. The questions included:

- How has your learning journey evolved over the past six months as a result of serving as a math liaison?
- Please share your perception regarding the liaison experience.
- How have you grown as a leader?
- What impact has your leadership had in your building in regard to mathematics teaching?
- Anything else you would like to share?

Liaisons shared their insights, challenges, and celebrations. They provided suggestions for making revisions to the program structure of math liaisons. This conversation showcased the work liaisons engaged in over the year, both in regard to instruction and leadership.

As a parting gift, facilitators presented each liaison with a picture frame. Within this frame was a quote by John Quincy Adams that read, *If your actions inspire others to dream more, learn more, do more and become more, you are a leader.*

Optional Lab Day: February 2019 (see Appendix T)

District funding supported a release day for the liaisons. On this optional lab day, teachers were granted a substitute teacher to cover their class to engage in a day-long professional development session. Liaisons decided if they wanted to participate or opt out of the lab day. This lab day was strictly a voluntary opportunity.

Of the 19 K–2 math liaisons, 13 chose to participate in the lab day. Liaisons chose to participate for the entire day or for a half day. Eleven of the 13 liaisons participated for a full day, while the other two liaisons chose to participate for a half day. Due to illness and inclement weather, only 11 liaisons attended. This resulted in nine liaisons participating for a whole day and two for a half day.

During the morning session, liaisons watched two different videos from NCTM's "Principles to Actions Professional Learning Toolkit" (NCTM, 2018). The videos were "Amanda Smith and the Donut Task: Kindergarten" and "Millie Brooks and the Half of a Whole Task: Grade 3". The participants watched each video twice. The first time the video was played, liaisons watched the video to get an overall sense of the situation. During the second viewing, liaisons collected evidence of the eight effective teaching practices. The liaisons used a protocol (see Appendix U), which was developed by the facilitators, to keep the conversation focused on the effective teaching practices.

Following the videos, the liaisons paired up. Each liaison brought a video clip from their own classroom to share. Liaisons watched these clips and engaged in conversation about the evidence they saw of the effective teaching practice they chose to focus on. To guide this conversation, the same protocol was used (see Appendix U).

Once all liaisons had an opportunity to share their video with their partner, the large group came back together and discussed the experience of observing each other's videos. Liaisons shared their thoughts about being videoed and watching it with a peer. They also talked about the effective teaching practices they observed. To conclude the morning part of the lab day, the liaisons set a personal goal for themselves based on the effective teaching practice they had previously chosen.

During the afternoon session, liaisons took time to explore the topic of equity in mathematics. To open the conversation, the liaisons engaged in a visualization activity (see Appendix V). This activity was designed to get the liaisons to think more deeply about personal biases and issues of equity in mathematics. Next, liaisons captured their thoughts about equity on Post-it notes by writing one word or phrase that they associated with the topic of equity in mathematics. All Post-it notes were placed on a white board and collectively, the group found common themes (see Appendix W). A conversation followed, in which liaisons discussed what equity in mathematics encompassed.

Next, the liaisons read pages 59-69 from *Principles to Actions: Ensuring Mathematical Success for All* (2014) and collectively discussed the chart from page 63 of the reading. This led into the next activity where liaisons worked in small groups to create posters that depicted an ideal equitable classroom (see Appendix X). The small group shared their posters with the larger group. Then, the posters were hung on the wall for the remaining portion of the lab day.

The lab facilitators gave the liaisons time to read pages 99-109 in *Providing Access to Equitable Mathematics Learning* from Wager et al. (2017). Once everyone was finished, the group engaged in a large group conversation based on the reading. Then, liaisons revisited the Post-it notes on the board from earlier and discussed the implications. To conclude the lab day, liaisons read pages 259-262 from *Taking Action: Implementing Effective Teaching Practices in Grades K–5* (Huinker & Bill, 2017). As an exit ticket activity the liaisons recorded their own goal, or call to action, based on equity in mathematics.

One-on-one Meetings

As a part of the expectation of being a math liaison, each K–2 liaison met with me. This meeting revolved around the liaison's personal learning journey. Liaisons scheduled dates and times on a case-by-case basis. Each liaison met with the district-level coordinator at least one time. Most of these meetings occurred in January or February, with a few meetings occurring prior to this time period.

The personal goals of each liaison determined the content of the meetings. These goals were based on the effective teaching practice each liaison identified as the focus of their work during the second professional development session. Most often, the meetings were brief and took place before or after school. Personal goals were discussed, as well as different options of support that could be provided by the district-level coordinator.

As a result of these initial one-on-one meetings, some liaisons chose to continue to actively pursue growth in their area of focus. A few liaisons asked to be observed while teaching a lesson. Others desired to plan a lesson. All requests were honored, as the focus was on personal and professional growth of the liaison.

Math Liaisons Focus Group

Six teachers who served as math liaisons for their building, were studied in greater depth for this study and hereafter are referred to as the Math Liaison Focus Group. This focus group consisted of five females and one male. These numbers are representative of the ratio of females to males in the overall math liaison group. To maintain confidentiality of the genders of the members of the focus group, I used gender neutral names and pronouns. Next, I briefly introduce the six liaisons who were a part of

the focus group. These introductions were generated through my interpretation of the teachers' descriptions of themselves.

The six liaisons included within the focus group were intentionally chosen as participants of this study. As a group, these liaisons represent schools from across the district. Students from these schools are representative of the district's overall population and make-up. The liaisons chosen ranged in years of experience and teaching assignment. Four of the six liaisons participated in the optional lab day, while the other two liaisons did not. The participants' involvement with past leadership experience in mathematics education varied. Four liaisons had no prior experience with leadership in mathematics education, while two previously exhibited leadership at the building and district levels.

Avery

Avery has taught for seven years and is in their third year teaching in this school. Avery teaches kindergarten along with two other teachers. The population at the school is approximately 500 students but the school is in a neighborhood that is experiencing rapid growth. In addition to serving as the math liaison, Avery serves on the building's courtesy committee called the Sunshine Committee. Avery also served as the building's Multicultural Liaison, representing the building at the district level.

Avery describes themself as being quiet and reserved. Avery shares that administrators at the building are supportive and provides opportunities for growth. Avery and the team members place a stronger emphasis on literacy professional development in relation to mathematics professional development. However, Avery believes more professional learning in mathematics content and pedagogy will be beneficial for the team.

Alex

Alex teaches first grade in a school that has a population of about 400 students. Each grade level has three teachers. This teacher describes the students at their school as hard workers. The students came from a number of different backgrounds, and many are overcoming obstacles presented by their home lives.

Alex has taught for 13 years and is involved in leadership at both the building and district levels. Alex serves as the first grade team leader for a team of three teachers. Alex participates in graduate-level courses on mathematics content and pedagogy and graduated with a master's degree in Curriculum and Instruction. Alex has worked with the current principal of the building for five years and feels the principal is supportive of their work.

Corey

Corey taught first-grade in a mid-sized school in the district, with approximately 100 students per grade-level team. Corey shared that while the students in the school came from unique homes, they were excited to come to school and ready to learn every day. When describing the culture of the school, Corey shared the school is conducive to learning, the learning environment was safe, and classrooms were inclusive for a diverse population of learners.

The year of the study found Corey in their third year of teaching in this school. Prior to being hired by the district, Corey acted as a long-term substitute, practicum student, and student teacher at this same school. Corey served as team leader as well as a liaison for mathematics and TeamMates. TeamMates is a school-based mentoring program for students. Corey acts as a member of different building committees. Corey

seeks opportunities to grow and learn professionally, and willingly shares the new knowledge they receive with grade-level teammates. Corey is grateful for the support received by the building's administration.

Taylor

During the study Taylor was in their fifth year of teaching having taught for two years out of state before moving into their current role. Taylor's school is considered small for the district, with two or three sections at each grade level. Students come from diverse backgrounds and a large population are English language learners. At Taylor's school, many students receive free or reduced lunch.

Taylor has a new grade-level co-worker and new principal. The former principal selected Taylor to be the math liaison; the new principal remains supportive of this decision. To assist the new grade-level teammate, the two teachers meet frequently, and Taylor shares knowledge previously gained. Taylor works closely with the building's instructional coach on a variety of aspects of instruction.

Parker

Parker serves as a second grade teacher in a school of approximately 700 students. Parker describes the school's population as having a higher socioeconomic status than many other schools in the district. While the school may not be as diverse as others in terms of backgrounds or beliefs, Parker shares there are diverse learning needs. Parker believes there are a wide range of learners at the school, all coming to school ready to learn and willing to work hard.

Parker is in their third year of teaching and student-taught at the same building before being hired. Parker recalls having positive math experiences through elementary and high school. Parker works closely with the school's instructional coach and feels building administrators provide encouragement for them to grow. Currently, Parker embraces learning opportunities offered by the district and is considering starting graduate school.

Vaughn

Vaughn has been teaching for 13 years, all but one being at the same school. Vaughn shared the population of the school is about 550 students, with three to four classes per grade level. Approximately 47% of the students receive free and reduced lunch. The school recently experienced an increase in English language learners.

In addition to being the school's math liaison, Vaughn serves as the grade-level team leader and is the chairman of the School Improvement Committee. Vaughn feels as if they have a good relationship with the building administrators and is appreciative for the opportunities given to them by this leadership team. Vaughn self-describes as a reserved person, one who embraces professional learning opportunities presented but does not seek out the opportunities on their own.

Summary

Chapter 4 provides an in-depth look at the professional development the liaisons experienced during the 2018–2019 school year. The math liaisons attended four in-person sessions. The liaisons solved math problems during these sessions and engaged in collective discussions regarding the elements of effective math instruction. These

conversations acted as a springboard for further discussions about the eight effective teaching practices identified in *Principles to Actions: Ensuring the Mathematical Success for All* (NCTM, 2014). The liaisons also met with district-level mathematics coaches on an individual basis.

In addition, this chapter provides a brief summary of the six liaisons who were intentionally chosen to participate in the math focus group. This group of teachers represent a wide range of characteristics found within the primary liaison group. These liaisons taught kindergarten, first, and second grades and have varying years of experience. The liaisons in the focus group exhibited leadership in mathematics education, at the building and/or district level. Members of the focus group were interviewed to gain a deeper understanding of my research questions:

> *RQ_1: What opportunities and contextual factors do K–2 teacher leaders identify as contributing to their growth as teacher leaders in mathematics?*
>
> *RQ_2: In what ways does a structured professional learning opportunity promote teacher leadership in K–2 teachers?*

CHAPTER FIVE: FINDINGS

The purpose of this study is to gain a deeper understanding of the opportunities and contextual factors that K–2 teacher leaders identified as contributing to their growth as teacher leaders in mathematics and learn more about the ways a structured professional learning opportunity promoted teacher leadership in K–2 teachers. In Chapter 5, I share the findings from my study. These findings come together to provide a deeper insight into the development of teacher leaders as a result of participating as a math liaison during the 2018–2019 school year.

My findings of individual liaisons act as pieces of information that when put together, provide a richer understanding of what it takes to develop as a teacher leader of mathematics at the primary level. Each finding comes together to give me a more in-depth view of how the liaison experience contributed to the teacher leader development in the teachers who participated as liaisons. Each findings, or big idea, adds another layer to my understanding of teacher leadership in the context of the liaison experience. Collectively, these pieces of information came together to build a deeper understanding of the growth of teacher leadership at the primary level as a result of the liaison's experience over the course of the 2018–2019 school year. Additionally, this information contributes to my overall understanding, or view, of teacher leadership.

First, I examine the data from each of the six liaisons in the focus group and use thematic analysis to provide insights into their stories as a math liaison. The themes that emerged through the liaison stories will be discussed. After presenting the findings from these six liaisons, I discuss the similarities and differences between these teacher leaders. I will share my findings and how these relate to my research questions:

RQ_1: What opportunities and contextual factors do K–2 teacher leaders identify as contributing to their growth as teacher leaders in mathematics?

RQ_2: In what ways does a structured professional learning opportunity promote teacher leadership in K–2 teachers?

Next, I will discuss the results from the survey that all liaisons completed at the beginning and end of the liaison experience. While these results represent a broader population than those liaisons who were a part of the focus group, the data reveals trends in how the liaisons' perception of their own leadership evolved over the course of the experience.

After I discuss the survey results, I explore the themes used during the coding process. Not all codes will be included, as some have been intentionally left out of the discussion due to the infrequency of the codes surfacing during the data analysis process. Following the discussion of the themes, I will compare and contrast these themes and discuss how the themes relate to the research questions.

At the end of the chapter, I draw conclusions about the overall findings in relation to teacher leadership. I will share my largest takeaways as a result of this study and how these findings assisted me in gaining a deeper understanding into answering my research questions. It is important to note that as I provide the findings, direct quotations from the liaisons will be used. All quotations used throughout this chapter have been directly pulled from interview transcripts, one-on-one meetings, liaison's mathematics stories, and artifacts, such as emails that came directly from the liaisons who participated in this study.

Cases of Math Liaisons

In this next section, I share the cases of the six liaisons. Each liaison has a unique story, one that led them to enhance their teacher leadership. Here I provide information about each liaison as well as important aspects of their personal journeys that have contributed to their development as primary teacher leaders of mathematics. The subheadings within each case emerged during data analysis, as common aspects of the cases became evident. I used these topics to organize each case.

After I present the individual findings, I will present the themes across participants. These themes, discussed in a later section, suggest that although primary teacher leaders work in different contexts and have varying experiences, they identify similar themes that have contributed to their development as a leader of mathematics.

Avery

Avery teaches kindergarten in one of the district's newer buildings. While Avery is the least experienced teacher on their school's team, they serve as the team leader. When speaking about the liaison experience, Avery shares, "I enjoyed it. It's been a great learning year for me." Avery felt grateful for the opportunity as this was their first in-depth professional learning opportunity in mathematics since they started teaching.

Experiences in Mathematics

Avery spoke about their prior experiences in middle school that led them to the teacher Avery is today:

> I ended up being in a challenge math group in middle school, but I just struggled there. I felt everyone else got it and like I really wasn't supposed to be there. And

so it was just kind of a struggle and I always thought I was pretty good with math until that point.

When Avery went on to high school, the same feelings continued: “When I went from sixth grade to high school, I always felt like it was just kind of hard and I didn’t maybe get it.” These experiences affected Avery’s identity as a mathematics learner, even though Avery was participating in a group for high ability learners (challenge group). They did not feel confident in their abilities.

College became a turning point for Avery. When referring to a class for pre-service teachers, Avery said, “That was really the first math class since basically sixth grade that I actually enjoyed and felt like I was getting something out of it.” Avery described this class as a turning point in their math story, as “that class really kind of turned a corner, you know, there’s a reason why that’s the answer not just because. That really kind of changed my whole look on math.” This collegiate class allowed Avery to see mathematics as worthwhile and something they could do.

Avery’s experiences in both middle school and high school contributed to who Avery is as a teacher and leader of mathematics. Experiencing struggle allowed Avery to better relate with students. Avery draws upon past experiences when teaching as they want the young students to understand mathematics, not just be worried about the correct solution. In addition, Avery draws upon these past experiences while serving as a teacher leader. As a teacher leader, Avery organized rotations for students to receive additional instruction following initial lessons on concepts. Avery commented, “In kindergarten, we worked in PLCs (professional learning communities) to make targeted instruction meaningful for our students.”

Relationship with Staff

Avery spoke to the relationship that has been established with the other members of the grade-level team: “For the most part, we work very good together. Everything is a shared effort.” This kindergarten team collaborates and routinely plans together. Avery values the fact everyone contributes to the work of the team.

Avery is a relatively new member to the grade-level team, being the youngest and least experienced member. Even though this is the case, Avery contributes to the team. Avery feels that serving as the building mathematics liaison has helped them take a more active role as a teacher leader:

> I’ve been able to take maybe on that leadership role a little bit more. I know kindergarten can be kind of its own world so it is nice that I feel like I may have taken on that role within my team.

Avery’s recognition of their own leadership may be due to the fact they had built confidence in their own understanding of mathematics and was more willing to share with their teammates.

In addition to working with their grade level team, Avery works closely with the building’s instructional coach:

> I’ve been working a lot with her. While I’ve mostly worked with her in reading, she has been so supportive and it’s been fun to collaborate with her. I was kind of her trial class this year. It was fun to be like her guinea pig.

Avery was willing to take risks with the instructional coach and try new things. They also recognized the instructional coach had specialized knowledge that they could learn from: “I feel like I can draw off their strengths that maybe I’m not the best at.”

Avery was willing to get advice and learn from someone who was viewed in the building as an expert.

In addition to having a strong relationship with the instructional coach, Avery feels they had a good relationship with the building's principal and assistant principal: "They're so supporting and also I think they're very trusting. They know you're going to do your job." Avery appreciates the fact that the building's leadership does not micromanage or dictate what happens with the classroom. Rather, the administration trusts the teachers of their school and believes that the teachers will do their job to the best of their ability.

Avery credits the principal with their growth as a teacher leader: "I approached the principal and said, 'I'm learning some great things and have some things I can share if you want." Avery was willing to take the new knowledge they gained from the liaison experience and share it with the principal as well as the rest of the staff. The principal agreed to give Avery time at a staff meeting to share about effective questioning in mathematics instruction. Avery shared a chart from the text, *Taking Action: Implementing Effective Mathematics Teaching Practices in K–Grade 5,* with other staff members that was used in the liaisons' meetings. The presentation was well-received:

> Usually I'm not one up there to present, but it was fun that I got to step in and share what I've learned. I think that it went really well, and it was a fun way to bring the knowledge back to everybody else.

The presentation to the entire staff helped others view Avery as a teacher leader of mathematics. Avery said,

> At the beginning, it was kind of hard with the change of the liaison. I sent an email saying things were changing this year. I think for the longest time they maybe didn't see me as one because I wasn't sending out emails or I didn't present until the February staff meeting. And so I think for a long time it was maybe a kind of gray area. But now I feel like after maybe I presented, then it's kinda of maybe a little more like, 'Oh, I could share, go ask that person.'

The perceptions of other staff members may have been that she was serving as the mathematics liaison under the former definition as a messenger of information, but it was not until after she presented that they recognized she had knowledge to share. In addition, Avery felt by presenting to the entire staff, they may have something to share with other grade levels in the future.

Opportunities to Grow

Avery commented the building had an intense focus on literacy. Literacy was the topic of the professional development work of all teams. While elementary schools often choose to have a literacy focus when they work on continuous improvement, Avery recognized the need for a focus on mathematics as well: "My team hasn't observed each other in math as we have in literacy, but we can all learn from each other." Avery adopted the mindset that everyone can learn, and everyone has something to offer. In addition, Avery would like to help shift the current focus from literacy to mathematics instruction.

Avery wants to encourage their teammates to not only focus on mathematics within the work of their building, but attend more district-level mathematics professional learning as well: "We've had a literacy focus the past two years. It would be fun to see it

shift the other way because I think that's something we could always improve as well. So, I'm hoping that shifts." Avery's increased focus on mathematics through liaisons expanded their interest in learning more about the subject. Avery views opportunities such as this to learn and grow. "I think I'll continue to improve," Avery said in regard to their learning journey in mathematics.

Personal Views of Teacher Leadership

Avery self-categorizes as being self-motivated, organized, and passionate. Avery strives to get things accomplished and has a strong belief system. Avery describes their view of teacher leadership as,

> They're willing to go above and beyond, do a little extra. They'll hear all sides of what is going on, concerns, complaints, and just how they can make things better. They want to change to make things better and the best that it can be. So, improving what needs to be improved and continuing what is going well.

Avery feels confident in being willing to stand up for what they believe is in the best interest of students. Avery said, "I'm willing to speak up and make change if something needs to be changed."

Growth from Being a Liaison

As a part of the liaison experience, each liaison received two professional resources, *Taking Action: Implementing Effective Teaching Practices K–5* (Huinker & Bill, 2017) and *Principles to Actions: Ensuring Mathematical Success for All* (NCTM, 2014). In relation to the texts for the liaison experience, Avery commented, "I've really grown a lot this year. Especially through reading the textbooks. I'm not one to really

enjoy textbooks but I just felt like they kind of hit home for things such as productive struggle." Avery added, "Learning about productive struggle in the text was most beneficial. It's okay to really struggle and see that though struggle students are going to understand a lot more than just if they don't have that." Avery felt the readings, and their application of these ideas to their own context, were worthwhile: "As a liaison, my teaching has improved so much."

The highlight of the liaison experience for Avery was the lab day. "I thought it was so fun to get acquainted with some of the other teachers." After participating in professional learning with the other teachers for the entire day, Avery felt as if they could reach out to them if Avery had a question. Avery commented, "It was nice to get to know people outside of your team." Avery believed the lab day helped develop relationships beyond their own team and building. Avery developed relationships with other teachers from the lab day and with district-level coaches: "I don't feel as scared to reach out with a question. Now it is like, 'Hey, I need help.'"

Final Comments

Avery summed up their learning by saying,

> I'll be honest. I've never really enjoyed teaching math and then this year I just felt like I enjoyed it so much more because I was able to take some of the experiences and make my teaching better. I felt a bit more confident about teaching math, and my kids seem to understand it better.

As a result of being a mathematics liaison and engaging in professional learning, Avery's feelings about teaching math shifted. Avery feels more confident in their ability

to teach mathematics as they engaged in professional learning, engaging in reflecting on their own instructional practices, and exhibiting teacher leadership.

Alex

Alex teaches first grade. When asked to self-describe, Alex used the terms learner and achiever. Alex was not new to leadership in teaching mathematics. Alex has been involved in leadership at both the building and district levels. Alex described their journey as a leader as "a little bit of a rollercoaster." This comment was made in relation to the ups and downs of leadership, as well as how their emotions about their own leadership fluctuated over time.

Experiences in Mathematics

Alex spoke about their own experience as a student. "Going into eighth grade Algebra without having pre-Algebra totally put me in that uncomfortable zone. It was probably one of the first times where I, in school, really felt like I was a struggler and not getting it." Alex felt this personal experience contributed to their work as a teacher in the classroom: "It's nice taking that aspect into my teaching where now I see that things don't always come easy and seeing the other end of it, but also knowing sticking with it, it finally all came together and clicked." Alex acknowledged that their patience and persistence contributed to their success and felt as if it was important to help their students recognize the value in these traits.

Past professional learning experiences were important pieces in Alex's growth as a learner, teacher, and leader. Alex commented that they found the professional learning sessions facilitated by the district to be very beneficial when they first started teaching.

However, Alex believed participating in an extensive graduate program was most impactful: “Primarily Math changed the way that I look at math and how I teach math. It was the discussions, seeing math from a different lens and getting the background that was the most impactful.” Primarily Math, a program for teachers in grades K–3, an 18-credit-hour graduate program for teachers initially funded by the National Science Foundation, combined professional learning experiences for teachers around both mathematics content and pedagogy. “It just put everything together,” Alex said as they spoke of the program. As a result of this new learning, Alex shared their newly gained knowledge with other staff members.

Relationships with Staff

Alex did not often work with the instructional coach in their building: “The instructional coach comes in and collects data for our school improvement goals. She also gives us technology information.” The instructional coach did not have expertise in mathematics, so this may have contributed to why the instructional coach did not routinely support Alex in this particular content area.

While Alex did not feel they had the strongest working relationship with the building’s instructional coach, they sensed they did have a strong working relationship with building administrators: “Our administration is so supportive and they are very easy to work with. They are receptive and when you have ideas or concerns, they take it to heart and a lot of times they will act on it.” Alex felt the support of the building’s leadership allowed them to grow as a professional and engage in the work of teacher leadership.

Alex serves as team leader for their grade-level team. The first-grade team collaborated well and shared a common mission. “We all want what is best for children,” commented Alex. As a leader of the group, Alex facilitated conversations that revolved around meeting the needs of all learners. In the past, Alex viewed their job as a team leader was to share information and get it to the others. For example, Alex believed it was their job to make PowerPoint presentations and share them with the rest of the team. However, Alex’s view of leadership shifted: “Now I focus on what is going to be powerful and meaningful.” In contrast to being a resource provider, Alex now facilitates conversations among their teammates while planning math lessons: “We’ve kind of started moving toward the instruction piece of it.” Alex feels the shift from concentrating on the tasks of a lesson to moving deeper into discussions about student misconceptions and aspects of instruction has been of benefit to the team.

Personal Views of Teacher Leadership

Alex believes a teacher leader serves as a resource for others. Alex suggests a teacher leader is:

> someone people can go to get advice and someone who can listen and share thoughts but also not be like you need to do it this way. Someone who is knowledgeable and kind of just willing to be there and help out. Also be open and vulnerable to the people that you’re leading.

When asked about how others perceive them as a leader, Alex said, “They know they can come to me and talk with me. We’ll have those more informal conversations about what’s actually happening in math.” Alex does not view their leadership as an

authority figure, but rather as a resource to others. Others see Alex as someone they can talk to, confide in, and get advice. Other teachers trust Alex.

When asked about their role in teacher leadership, Alex described it as “a roller coaster.” Alex continues, “I think this is great and going good. But then I look back and realize I keep learning.” Alex realizes there are ups and downs of leadership. Alex acknowledges being a leader isn’t always easy: “I don’t ever want people mad at me. I don’t want to step on toes.” Even though they feel uncomfortable at times, Alex realizes it is a part of being a leader.

Alex engaged in teacher leadership prior to serving as a mathematics liaison. This leadership took place at both the building and district levels. Alex volunteered early in their career, and prior to participating in the Primarily Math program, to pilot new curricular materials. Alex believed by participating in the pilot, they would have “a good opportunity to step outside of my comfort zone.” This experience served a springboard for Alex’s later experiences in relation to mathematics.

Alex’s work in the pilot was recognized, and Alex was tapped for other leadership opportunities. Alex facilitated district-level professional development for teachers regarding the curriculum that was adopted at the conclusion of the pilot. Alex facilitated sessions for new teachers at the beginning of the school year. While Alex was active in leadership at the district level, they had not been as involved recently due to personal reasons: “Liaisons kind of got me back into it. I feel like I’ve kind of been out of that and I missed it.”

Growth from Being a Liaison

While Alex shared they did not develop new relationships as a result of being a liaison, they commented how being a liaison impacted them in other ways. Speaking specifically about the lab day, Alex said,

> The lab day was hands down definitely the most powerful part of liaisons. It renewed some of the teacher piece for me as it has been a challenging year. I've felt burned out and tired. But just getting to have those deep hard conversations with other great teachers was just the kind of the shot in the arm that I needed.

Alex was speaking of the conversations that were spread across the lab day. In the morning, the liaisons discussed effective mathematics teaching practices. During the afternoon, conversations shifted to the topic of equity in mathematics: "Discussing equity gave me another lens to look at as a teacher with my students. So that was a powerful thing. While someone came to our building and discussed cultural proficiency and equity, I needed this conversation to get to a little bit of a different level, which was nice." Alex appreciated the deep conversations that allowed them time to get to talk with other colleagues about mathematics teaching, much like Alex did during their previous learning experiences that focused on mathematics.

Final Comments

Alex felt many components in their professional journey contributed to their success as a teacher leader: "Going feet first into leadership opportunities. But being involved in Primarily Math in which I learned about math and was able to practice, it also played a part. Looking at mathematics from a leadership role." Alex recognized that the

many experiences they had allowed them to gain insights that they might not have developed otherwise.

While Alex's journey to become a teacher leader began before becoming a mathematics liaison, they found serving as the building mathematics liaison was worthwhile. Alex's participation as a liaison did not necessarily jump-start their journey as a teacher leader of mathematics. Rather, being a liaison acted as a renewal of their interest in learning about the subject and provided a context for Alex to engage in deep, professional conversations with others about mathematics.

Corey

Corey, a first-grade teacher, believes being a teacher and learner run parallel. "A teacher is always a learner. I feel as if it is a gift to be a teacher and I feel like I'm constantly learning in and outside of the classroom," Corey said, as they talked about their work. Corey embraces the role of mathematics liaison as Corey gained new knowledge and shared it with others.

Experiences in Mathematics

> Corey began to doubt their abilities as a learner of mathematics in high school:
>
> There was no teaching me when it came to math. I had very low confidence in the subject which was different for me because all through elementary and middle school I was in differentiated (high ability learner) math. When I got to high school I kind of hit a slump and it was harder for me and I didn't feel very supported.

Corey's high school experience in mathematics served as a turning point in their journey as a learner of mathematics because they lost confidence in their abilities. Leaving high school, Corey knew they wanted to be a teacher and thought, "How am I supposed to teach math when I'm very bad at math?"

> Corey's thoughts about their own mathematical abilities changed in college:
>
> I found very supportive teachers that really walked us through how to teach math and how to understand math in general. And I realized that I was and could be good at math and that gave me a really strong confidence base.

Corey gained a greater understanding of mathematical concepts and how to teach the concepts. Cory also revised their unsuccessful feelings from high school. These college professors influence who Corey is as a teacher of mathematics, and Corey strives to provide similar experiences for their own students. "This let me see that no one is bad at math. My students can be successful with the right teaching, tools, and strategies," Corey said.

Relationships with Staff

Corey feels "really close with my team." Corey recognizes one teammate who Corey believes has influenced themself and serves as a valuable resource when it comes to mathematics instruction. "I feel supported by my team," Corey said. This close relationship plays an instrumental role in the success of the team's work and allows the team to tackle difficult situations. "We've had some critical, really hard conversations," said Corey. This related to the conversations Corey initiated which confronted current practices based on their learning through liaisons' meetings regarding effective teaching practices.

Corey has a strong relationship with other leaders in the building. “I feel close to my principal. She is both a teacher and an administrator. She has a good pulse of what classrooms should look like and feedback,” Corey said. Corey believes the principal serves as an instructional leader as well as other duties as a building principal. Corey feels supported by the principal: “It is important to not only evaluate teachers but also support them with what they need.”

As well as having a strong relationship with the principal, Corey views their relationship with the building’s instructional coach as worthwhile. “The coach is amazing. She gives me strategies and tools I can use in the classroom. I don’t know where I’d be without her help.” Corey welcomes the coach into their classroom on a regular basis to observe. “She gives me resources but also advice about graduate school and other things.” Not only does Corey believe the relationship with their building coach contributes to their work as an effective teacher in the classroom, but Corey also values her insights regarding continued professional learning.

Personal Views of Teacher Leadership

Corey shared three-fourths of the leadership opportunities have been given to them, while Corey does seek out some on their own. Corey acknowledges this is because they shared that Corey was looking for opportunities to grow and learn with building administrators. Showing interest in pursuing new opportunities made Corey’s principal aware of their willingness to grow as a teacher. In turn, the principal provided Corey with multiple opportunities to expand their abilities as a teacher. However, Corey feels taking initiative on their own is important as well: “You can only get so far with other people

offering you opportunities. You really need to be proactive and get out there and find ways to be a leader."

Corey describes themself as patient, one who loves data, and one who sees how things influence the classroom. These characteristics are useful as a teacher leader as Corey wants to try out instructional practices first and then be willing to share them with others. In addition, Corey is willing to meet with anyone in the building. This is aligned with their view of teacher leadership. "I think a teacher leader is someone who is willing to serve first. I think overall a leader needs to have a service-based mindset," Corey said.

Corey feels as if one of their greatest strengths is their admiration for their students. "I love my students," said Corey. Others in the building recognize Corey's passion for young students:

> I think others in the building recognize I'm willing to go out on a limb and be vulnerable. I'm always willing to help others. People recognize I spend extra time doing anything and everything just because I feel like overall we need to be successful as a building.

Opportunities to Grow

Corey recognizes that a number of learning experiences over time have contributed to their growth as a teacher and leader. Due to their growth mindset, Corey takes advantage of different learning experiences and actively seeks out new experiences. "There are so many opportunities in teaching to grow and expand your learning and knowledge base. You just need to be proactive about it," Corey said.

Corey senses their work as a liaison will not end at the conclusion of the liaison experience. Corey believes their leadership in mathematics education is just beginning.

“Next year, I want to continue to use the texts, collaborate with the new liaison and want to take even more of a leadership role by stepping out of my comfort zone and reaching out to other grade-level teams,” Corey said. Corey does not view their duties as a math liaison ending, as the experience comes to an end. Rather, Corey wants to continue expanding upon their own leadership.

Growth from Being a Liaison

Corey believed many of the components of the liaison experience were beneficial. Specifically, Corey found reading professional resources useful. Corey chose to focus on questioning strategies. “I see there are methods and strategies to teaching mathematics and these ways have been tested and proven,” Corey said. In addition to the reading, Corey saw benefit in having conversations that centered on mathematics instruction with other liaisons. Diving into an effective teaching practice of their choice allowed Corey to also see what they are doing in their classroom and how future grade levels will build upon it. This exploration provided Corey with a broader view of teaching mathematics.

Corey believed one year as a liaison was not enough, however they understood the structure was developed to allow for more teachers to participate as a liaison. Corey wished the experience was longer than a year as they felt there was not enough time to dive into the learning and share the new learning with others in a way that would be impactful in their own instruction. “I want to stay in touch with next year’s liaison and continue to grow,” Corey said. Corey saw value in developing a partnership with the building’s new liaison and continuing the work they started.

Final Comments

Corey could not say enough about how they found being a liaison a worthwhile experience. “I grew in my competence as a math teacher. I felt a lot more confident in my understanding of the curriculum, and feel more empowered to talk about math,” Corey said. Corey’s confidence comes from the knowledge that they gained regarding effective mathematics instruction as well as experiencing teacher leadership. Corey summed up their thoughts about the liaison experience by saying, “Liaisons affirmed my belief of what a leader should be.”

Taylor

Taylor, a first grade teacher, experienced a number of changes. Taylor had a new principal in the building as well as a new grade-level teammate. Taylor embraced these changes, and appreciated serving in the role as mathematics liaison. Through these transitions and new experiences, Taylor maintained their commitment to students. “I think when your number one priority is student learning, it changes your mindset,” Taylor commented as they described the work involved as a teacher leader.

Experiences in Mathematics

Taylor’s background as a learner provides them with insights about teaching. “In fourth grade, I tested into high math. I don’t know how, as when I got there I did not understand what was happening. I struggled from that point on.” Taylor’s personal experience of not understanding the mathematical concepts affected their teaching as Taylor does not want to replicate this experience for their students.

Taylor credits a college class to helping them realize what mathematics is about. “I finally found a way that worked for me when I was 20, then I could understand other ways of doing mathematics.” While Taylor understands mathematical procedures, or traditional ways of solving math problems, Taylor prefers alternate strategies as they better understand in this way. They commented that this understanding of being able to look at mathematical ideas and problems from a different perspective proves to be beneficial as they work with their students.

During Taylor’s first few years of teaching, Taylor received sound advice from a beloved aunt who taught high school. This aunt was a math teacher in another state. Taylor would call the aunt to gain advice about concepts they were teaching to fifth-graders. Their aunt would not only help them work through the concepts, but provided Taylor things to think about in relation to elementary mathematics. “My aunt told me, ‘They need a foundation for math.’” Receiving this advice was beneficial, as Taylor realized it was their job to get young students to understand foundational concepts of mathematics so they can be successful in the future.

Relationships with Staff

Taylor’s grade-level team consists of two other teachers and themself. Taylor takes the lead by facilitating regular collaborative planning sessions. “We plan on Wednesdays and I think it’s been really helpful,” Taylor said. Taylor believes all of the students in the grade level are “our kids,” in contrast to “yours and mine.” Planning together helps provide equitable learning experiences for all students within the grade level. “I hold my team accountable for our students,” Taylor said as they described their work in this area.

Members of a team do not always come to a consensus. “It’s sometimes about having hard conversations,” Taylor said. Taylor tackles difficult situations as a leader, as Taylor believes the team has the same mission when it comes to student learning. “I’m a person of data, so we sift through things that are unsuccessful,” Taylor commented on how they handle uncomfortable situations as a teacher leader.

Taylor provided information about their relationship with other staff members in the building. When talking specifically about administrators, Taylor said, “I really like them both. I trust them.” Taylor has developed this trust in a short time frame, as the principal is new to the building:

> It was a little scary when the new principal came just because I was used to the former one. I have a different relationship with this new principal than I do of the assistant principal. I see her as my teacher.

Taylor is most proud of their collaboration with the building instructional coach: “I have asked the coach to come into my classroom a lot because I want what is best for my students.” Taylor believes this partnership is an important part of their growth as both a teacher and a leader. Taylor finds the work with the building coach to be very valuable, so they were hoping to partner with both their team and instructional coach moving forward.

Personal Views of Teacher Leadership

Taylor finds self-describing themself as a leader to be difficult: “When people say, you are a leader, I just say I’m doing my job.” Taylor sees teacher leadership as being reflected in their actions: “I feel I lead more by example than telling people to do

this or to do that." Taylor does not view leadership as a position of authority, but rather as setting standards for others to hold themselves to.

Taking initiative is one aspect of leadership Taylor sees as contributing to their success as a teacher leader: "Somebody has to be the one that's like we need to get together and figure this out." Taylor is willing to take risks and be vulnerable in the presence of others. "Others view me as a leader because I ask for help or I ask questions," Taylor said. This willingness to make the first move and reach out to others allows others to realize Taylor's potential as a leader.

Growth from Being a Liaison

Taylor embraced the challenge placed upon the liaison group to exhibit teacher leadership within their respective buildings based on their learning. Taylor found different aspects of the two texts to be worthwhile. In collaboration with the building coach, Taylor took these excerpts from the texts and sent them through emails to the staff. Taylor shared, "I wanted to challenge the staff." These actions of teacher leadership distributed the knowledge they were learning to other members of the staff.

Taylor found having time to collaborate with others as beneficial: "Being around other educators was great." Taylor felt it was useful to talk and collaborate with others from around the district, as it was easy to get caught up in the issues facing their particular building. "I saw this was a universal problem, not just my building's problem," Taylor said. This experience allowed Taylor to see beyond their building and realize the many issues their building was facing was not isolated to their context.

Final Comments

Taylor wants to continue the learning they began as a mathematics liaison. “I’m really excited for next year as I want to take the new math class to get a deeper understanding and listen to other people talk about math and how they do things,” Taylor said. Taylor recognizes teacher leaders are continuous learners and is ready to commit to other large-scale professional learning experiences. In addition, Taylor desires to work with the next year’s liaison. “I would really like to partner with the next liaison and see what kinds of things we can do for our building,” Taylor said.

Parker

Parker is relatively new to education. Going into the liaison experience, Parker felt uneasy due to the fact they had very few years of teaching experience. “I felt tension in being only 26 and in my third year of teaching. I don’t have as many experiences as other veteran teachers,” Parker said. Parker fully embraces being a mathematics liaison.

Experiences in Mathematics

Parker views their personal math journey as mostly positive. “I always felt like math came super easy to me when I was younger,” Parker said while describing their own learning experiences as a student. “Math has always been my favorite subject as part of it I think is because it came easy to me and I really thrived in it.” When it comes to mathematics, Parker’s memories are joy and pleasure. These feelings are what Parker draws upon as a teacher.

Parker recalled a time as a student when they were asked by the teacher to help their peers figure out a math problem. It was at that point that Parker realized math was a

strength. Parker contributes this experience to helping themself believe in their own capabilities, and recalls this when working with students in their own classroom.

Relationships with Staff

When asked to self-describe, Parker uses the words "learner, teammate, and advocate." Parker exhibits these characteristics as a member of their second-grade team. "We are constantly talking about what we are doing in classrooms," Parker says as they describe the working relationship among teammates. In addition to ongoing communication, the grade level engages in regular team meetings. "We want to make sure we are on the same track of which activities we are doing," comments Parker about what takes place during team planning sessions. Parker feels as if they are a strong voice for students and brings a perspective into the meetings that others may not have. "I'm always active and present during meetings with my team," Parker shared.

Parker maintains a strong relationship with the building principal: "Administration is here for support." This support varies from sharing resources to taking time to collaborate on projects that will benefit the entire staff. The building principal often shares new learning resources with Parker, as he is aware that Parker is a teacher who is always looking to learn more in regard to instructional practices. Parker feels as if the building leadership not only provides ongoing support but also urges them to grow professionally.

Personal Views of Teacher Leadership

Prior to becoming the mathematics liaison, Parker lacked confidence in their abilities as a leader. "I feel like I'm more confident due to the fact I was asked to be a

math liaison. That was a good message for me," Parker said. Parker did not necessarily see their potential as a leader in the area of mathematics, but through the liaison experience Parker gained confidence in their abilities. "I'm a lot more confident because I have these tools that I'm able to use," Parker commented. Parker believes the knowledge and confidence gained while being a math liaison would be useful as they work with others in the future.

When asked how they would describe a teacher leader, Parker believes it is someone who works well with others, comes prepared, and holds others accountable, as well as themselves: "Like sometimes you need it, check yourself and realize you're not doing what you need to be doing." Parker views teacher leadership as not only holding themself to high standards, but others as well. Parker often asks themself, "What do I want to learn from this and what can I bring to the table in the area of leadership?" Parker identifies teacher leadership as being a service to others but also realizes that they benefit as well.

Through their work, Parker came to understand that being a leader is not something another bestows upon someone. Rather than waiting for someone else to approach them to take a more active leadership role, Parker told themself, "I'm in this position for a reason and I need to recognize that." Therefore, Parker sought ways to use the position as a liaison to help others grow: "If I didn't, I was being selfish with my learning." Although Parker was not ready to step outside of their comfort zone, their inner voice whispered, "You just have to." Parker felt it was their obligation to share their new learning with others.

Growth from Being a Liaison

When asked about the components of the liaison experience, Parker saw benefits in each one. Parker said,

> The professional texts were good. It wasn't overwhelming that I had to read the entire book. We got to focus on just one area which was more realistic with everything else that is going on in our lives. But I also feel much more knowledgeable about that topic.

Parker appreciated not having to read the texts in entirety, but instead found that diving into a section was most beneficial. Parker chose to present to their staff on the effective teaching practice they focused on through their liaison work. Parker said,

> I felt like I needed to go to my entire staff as a whole and say, look what I'm learning about. This is what I'm doing in my room and here are some things you could use or if you already use this you can celebrate those things.

Parker felt the presentation to staff was well-received, even though it was out of their comfort zone: "Others didn't see me as a leader of mathematics until I presented to the staff."

Parker spoke to the different components of liaisons they believed helped them grow as both a teacher and leader. "The lab day was a really good experience as I stepped aside from working and got to spend time with other teachers in the district," Parker said. Parker found benefit in the extended time to reflect upon their practice in addition to the time to connect with other teachers. "I built relationships with other people around the district," Parker commented. Parker got to know other teachers across the district, as well as district-level coaches, through their participation in the lab day.

In addition to finding the lab day as beneficial, Parker saw benefit in the other opportunities they took advantage of while being a liaison. Parker invited the district-level coach into their classroom. Parker found value in having a district-level coach come observe their classroom and engage in a reflection conversation afterward: “It validated things I was already doing that were working. And I felt as if I could then tweak or enhance the things that I needed to focus on.” Parker felt this observation and follow-up conversation was useful in helping them move forward with the effective teaching practice they had chosen as a focus.

Final Comments

Parker spoke highly of their experience as a liaison: “Being a math liaison presented me with lots of opportunities that helped me grow.” Parker values the time they spent and perceives this experience as contributing to their overall professional growth. Parker aspires to set new goals for themself as Parker did not want the experience to end. “I will continue to work with next year’s liaison, and do staff meetings,” said Parker, as they believe there is more work to do as a teacher leader of mathematics education.

Vaughn

Vaughn teaches second grade. Vaughn has been involved in teacher leadership in mathematics prior to being a liaison, both at the building and district levels. Vaughn commented that when they first started teaching, they did not envision themself as a leader in mathematics. “I guess when I first started teaching, I never would have pictured myself taking on the math leadership role,” Vaughn said.

Experiences in Mathematics

Vaughn's experiences as a student impacted who Vaughn is as a teacher of mathematics. In elementary school, Vaughn was in a low math group: "I feel like that really took a tremendous effect on my view of myself as a math student. I was not very strong in math." Vaughn shared how their experiences as a learner of mathematics influences their teaching and leadership. "My experiences are probably why I advocate against certain things," commented Vaughn as they spoke about their beliefs as a leader of mathematics.

Vaughn credits two of their high school teachers with gaining a fresh perspective on mathematics as a learner. "I feel like she [geometry teacher] helped me figure out what my view on math is more about. It's not about whether you're smart or not smart but it is about having a growth mindset," Vaughn said. The other teacher "helped me see that yes, I can do the math because of hard work and effort. It's not whether you have it or you don't." Vaughn continues to believe this to be true and applies this mindset to their work as a teacher leader.

Relationships with Staff

Vaughn's building had an instructional coach. While the coach tended to focus his efforts on technology, instruction in mathematics was not a priority on the coach's agenda. "It was kind of more like me helping him than him helping me." Vaughn found opportunities to share their knowledge with the coach when possible.

Vaughn has a strong relationship with the building leadership team: "I feel like I have a really good relationship with them. They are really supportive." Vaughn senses the support from the building administrators as Vaughn was named chairman of the

school improvement committee. “I see what we need to do as an entire building,” Vaughn shared about their leadership that has extended beyond the classroom and grade-level team.

Within the second-grade team, Vaughn serves as team leader. Part of this responsibility includes leading conversations about instruction. “We’ve really made sure that when we plan lessons that we are doing what we need to do,” said Vaughn about how they shifted the focus of the work during team meetings. “When we are collaboratively planning a math lesson, we get down deep into the components and I’m not wasting time, but rather using time to our advantage,” Vaughn said. Vaughn planned for new team members for the upcoming school year, so they thought about facilitating team planning sessions with new dynamics due to the addition of the new staff.

Personal Views of Teacher Leadership

When asked about their own leadership characteristics, Vaughn self-describes as responsible, consistent, positive, trustworthy, and disciplined. Vaughn believes a teacher leader is someone who does not play safe, one who is not comfortable with the status quo. “A teacher leader needs to be a risk taker, and you have to be OK to be uncomfortable to make growth.” Vaughn not only sees potential for growth in others but also in themself. “I’ve grown a lot and I’m not there yet. There is more I can do for myself, my team, and the whole school,” Vaughn said.

Vaughn senses their peers view them as a leader. “People trust me,” Vaughn said of how they believes other staff members consider them as a leader. Even though others view them as a leader, Vaughn often needs to be nudged to do so. “I’m usually approached by things and I feel pretty reserved. Again, it is where I need to be pushed to

do things. But you have to be uncomfortable to be able to grow," Vaughn said. Vaughn believes the encouragement of others is a key to their success as a leader.

Looking forward, Vaughn has goals for themself: "I'd like to challenge myself to do something to support myself as a learner of math." Vaughn recognizes they has more to learn as a teacher leader of mathematics. In addition, Vaughn believes their building would benefit from more professional learning opportunities for mathematics; therefore Vaughn desires to partner with the building's new liaison to create such experiences. Vaughn identifies this as an opportunity to grow themself and to help others grow as well.

Growth from Being a Liaison

Vaughn appreciates the new structure of the math liaison experience. "I really appreciated the format of liaisons as it was more like professional development and not just a 'here is the info, share this with your school.' It was a better use of our time and I was given a chance to reflect on my teaching as well," Vaughn said. In addition to having a chance to think about their own teaching, Vaughn likes the fact that they had the opportunity to talk and collaborate with teachers from other buildings.

The change in the structure of the liaison was designed to provide more robust learning experiences for teachers. Vaughn values this change: "I shared the shift in liaisons with my team and they wished they could be a part of it too. So I always share with them what we learn from the two books." Vaughn talked about how they shared this information with peers. "I also took the questions from *Principles to Actions* and incorporated them into our collaborative planning sessions," Vaughn said. Vaughn

applied this new learning to their own practice and also shared their knowledge with their peers.

Vaughn specifically spoke of how the different components of the liaisons' meetings contributed to their own growth. "Having the time to write that math story was beneficial. I feel like that reflection piece was really helpful," Vaughn said. In addition, Vaughn saw benefit in focusing on one area of instruction. "Focusing on one thing versus lots of things" allowed Vaughn to channel their efforts into one specific area of their teaching. As part of this focus on one effective teaching practice, liaisons had the option of choosing to video a lesson and engage in reflection with me. Vaughn felt videoing a lesson and reflecting upon it was worthwhile. Vaughn was able to think deeply about the specific strategy they chose, which helped them determine which aspects of their instruction were going well and what they could improve on. While Vaughn thought the learning they engaged in was worthwhile, they wondered if selecting the focus earlier in the year would have allowed more time for the math liaisons to grow.

Final Comments

Vaughn is grateful they had the opportunity to serve as their building's liaison. When asked if there was anything more they would like to share, Vaughn commented,

> I just really appreciated how it was more of a staff development than like, here's the information please share it with your school. It was a better use of our time and I enjoyed the resources that I was given and the chance to really reflect on my own teaching as well.

Vaughn embraced the opportunity of serving as a liaison to grow and also shared their knowledge with others through their teacher leadership.

Summary of Cases

In this section, I synthesized the cases of the six liaisons who participated as part of the focus group. While the math liaisons' individual journeys to teacher leadership in mathematics education varied, there were commonalities that emerged in regard to what contributed to their leadership. These commonalities include a personal, productive struggle with mathematics, supportive building administrators, and a positive mindset that leadership matters. A deeper synthesis will be provided regarding these findings in Chapter 6.

Surveys

Next, I will discuss the surveys I asked the liaisons and principals to complete. Each liaison rated themselves in relation to the teacher leadership indicators on the survey. This took place both prior to and at the completion of the liaison experience. I analyzed the pre-survey and post-survey results. Comparisons were made between the pre- and post- answers, determining if changes had occurred within the liaison's feelings and perceptions regarding their own teacher leadership.

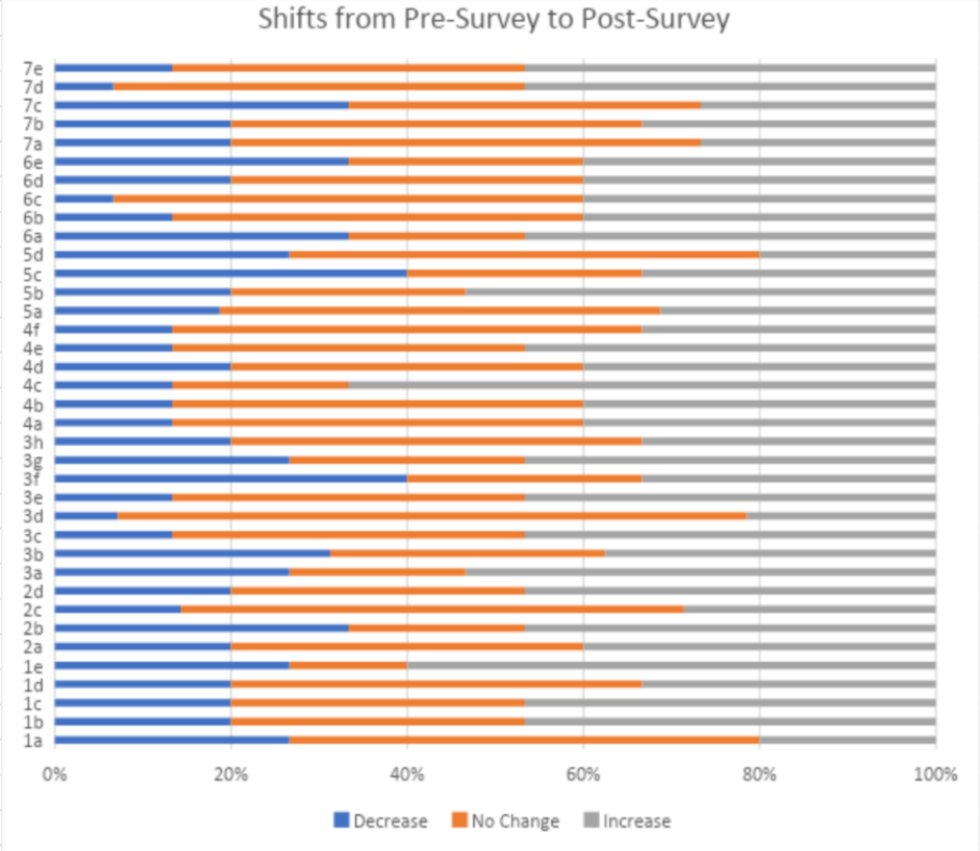
As part of data collection, I also asked each liaison's principal to complete a pre-survey regarding their liaison's leadership. As indicated in Chapter 3, the return rate of the principal surveys was lower than expected. Unfortunately, this low return rate did not produce enough data for me to make inferences regarding the principals' perceptions of their liaison's initial leadership. Therefore, I did not analyze the principal surveys as part of the data analysis process.

Figure 13 provides a visual representation of the shifts that occurred from the liaisons' pre- to post-surveys. The nature of a shift was positive, negative, or had no

change. The shifts were determined by the liaison's individual rating for each indicator. If a liaison originally indicated a marking of a four on the pre-survey but chose a score of a five on the same indicator on the post-survey, this signified an increase. The opposite movement of scores, such as from a score of a four to a three, reflects a decreasing shift. These shifts varied in value; however, the results solely indicate the change as increasing or decreasing. Scores that remained constant are characterized as no change.

Figure 13

Liaison Shifts on Perceptions of Leadership Indicators From Pre-survey to Post-survey



Overall, the shifts in the liaison's responses from the pre- to post-surveys were positive. This means their perceptions of their own leadership characteristics increased.

For each indicator, at least a 20% of the liaisons increased in their perceptions of their leadership with respect to the indicator. For a majority of these indicators, there was an increase of 40% or more. One may conclude the liaisons began to recognize their own leadership strengths as a result of participating as a liaison. The decreasing shifts in responses appear to be between 8% and 40%. This decrease in responses may be as the liaisons learned more about leadership, the more they felt they had to learn or do.

All of the indicators on the survey saw overall increases in the liaison's perceptions of their own leadership from the pre- to post-survey. The most significant increase was on indicator 4C. This increase fell within the big idea of facilitating improvements. Liaisons' responses indicate they perceive they are doing a better job at supporting colleagues' individual and collective reflection and professional growth by serving as mentors, coaches, and content facilitators. Another indicator showing a noticeable shift in responses was 1E. This indicator relates to teacher leadership in a collaborative culture. Approximately 60% of the liaisons indicated they grew in the area of using knowledge and understanding of different backgrounds, ethnicities, cultures, and languages to promote effective interactions among colleagues.

Two teacher leadership indicators increased 25%. Liaisons felt they were doing a better job of promoting professional learning by collaborating with colleagues and school administrators to plan professional learning that was team-based, job-embedded, sustained over time, aligned with content standards, and linked to school or district improvement goals. An additional area of leadership displaying a sizable shift was that liaisons sensed they collaborated with colleagues in the design, implementation, scoring, and interpretation of student data to improve educational practice and student learning.

Both shifts reflect the liaisons' teacher leadership actions, coming as a result of their work as part of the liaison experience.

The survey data provides insight that the math liaisons believed they displayed more teacher leadership characteristics at the conclusion of the liaison experience in contrast to that in the beginning. This may have been due to the fact the liaisons were more aware of their own leadership strengths and contributions after thinking about leadership in mathematics education over the course of the year. Or, the liaisons may have noticed growth in their own leadership as a result of being a liaison. A number of liaisons indicated they exhibited leadership in ways they had not before due to their deepened knowledge about mathematics pedagogy. It is difficult to pinpoint what exactly caused the positive shifts in the liaisons' self-perceptions of leadership; however, it is to be noted that participating as a liaison did appear to cause upward trends in the responses.

Codes

After each interview, memo, and artifact were coded, I looked through the individual codes to find themes that emerged. Next, I share information for each code that provides insight into the big ideas that surfaced within each of the eight a priori codes. These big ideas provided useful information as I attempted to draw conclusions to answer my two research questions.

Professional Development-Content

There was a dearth of data that surfaced in regard to mathematical content during the data collection process. This may be due to the fact the liaison experience did not specifically address mathematical content. Liaisons engaged with a mathematics problem during the second liaison meeting; however, the focus of the follow-up discussion

remained on the pedagogical approach rather than the mathematical content of the problem. Therefore, I did not analyze content data that was gathered during the study.

While it was the original intent to have liaisons explore mathematical content, this initial goal quickly faded into the background as pedagogy took over. Discussion centered on content most likely would be different, as many teachers become anxious when engaging with mathematical content with which they are not comfortable. Perhaps the transition from the initial goal of content, to focusing solely on pedagogy, provided a safer way to invite the liaisons to get involved.

Professional Development-Pedagogy

Liaisons appreciated the shift in the liaison structure which focused on understanding of the effective teaching practices from *Principles to Actions: Ensuring Mathematical Success for All* (NCTM, 2014). The liaisons embraced this change in approach, recognizing the experience became more of a professional growth opportunity that it had in the past. As one liaison said,

> I just really appreciated how this was more of a staff development than like, "Here's the information and please share it with your school." I just feel like it was a better use of our time, and I enjoyed the resources that I was given and the chance to really reflect on my own teaching to do well.

This shift in liaison structure was a deliberate decision made by the facilitators: "I really liked that you guys have us pick one of the teaching practices, as I did purposeful questioning." Another said, "It didn't overwhelm me at first. I knew I was just going to work on this one teaching practice." One other liaison shared, "I really liked how it wasn't really an overwhelming thing where I was like, 'I have to read this huge book

before we go back.'" Zeroing in on one effective teaching practice provided time for the liaisons to gain a deeper understanding of the specific practice they chose. "Learning about productive struggle this year is what I focused on and it was so great to hear that struggle is OK, and it's OK if students maybe don't know the answer right away," one liaison said. Another liaison was appreciative of the knowledge they gained about purposeful questioning: "I will continue to improve as I get used to asking different types of questions." The liaisons felt they grew in their understanding of the effective teaching practices as a result of participating.

Reflection was an important part of the liaison's experience. One task the liaisons were asked to partake in was to reflect upon their past as a learner and teacher of mathematics and write a short math story. "I valued the time to write that math story. I feel that the reflection piece was very helpful," one liaison said. Another liaison said, "I wasn't even aware I was already doing some good things in relation to productive struggle but then I had time to think about it." Yet another liaison shared, "I videotaped myself. I didn't have anybody else give me feedback but rather I just looked at it myself. I think taking a step back and looking at yourself in a different way is helpful." Each of these activities that the liaisons participated in allowed them to think about their own teaching in relation to mathematics.

One expectation of the liaisons was to meet one-on-one with a liaison facilitator. The focus of these meetings was determined by each individual liaison. Some liaisons chose to collaboratively plan a lesson with me, while others asked me to observe a lesson and provide feedback. "I really liked the classroom experience," said one liaison. Another shared, "I asked her to come in a lot because I wanted to be doing the best that I can for

my students." The liaisons valued being able to apply their learning of the effective teaching practices to their own contexts and appreciated the choice of how I would provide support. "I liked when we wrote on sticky notes if we wanted you to come out to our classroom and do a lesson, help us plan, or watch a video or something that we did. I enjoyed that." One liaison stated, "Having you come out to my classroom and observe me and then coming back out and reflected on the lesson with me were good opportunities."

One aspect built regularly into the liaison experience was collaborative conversations. The liaisons valued the time they spent talking with other liaisons. "I really enjoyed being able to have conversations centered around math with other teachers at my grade level as well as other grade levels," shared one liaison. Another said, "I really had a good experience working with other teachers from the district, which we don't always get the opportunity." Many of these discussions centered on the effective teaching practices; however, some were more general in nature. "Anytime we can get people together to talk about what we do and have conversations about the reality of what's happening helps me understand I'm not the only one experiencing these things in relation to teaching mathematics," declared one liaison as they spoke to the value in having the opportunity to talk about mathematics with other liaisons.

The liaisons commented positively on the texts that were distributed to the liaisons: "I thought the texts you gave us were very, very helpful. They were important components to my learning experience." Another said, "I especially liked reading the textbooks. I'm not one to really enjoy textbooks but I felt like they kind of hit home, especially on productive struggle." One liaison stated, "I really enjoyed those professional books that we got." Many liaisons spoke of how they planned to continue to

utilize the resources, reading about other effective teaching practices in the future. One of the features of the textbooks that liaisons seemed to appreciate the most was the classroom vignettes: “When there’s a case study, I can see my students in the students in the book. I feel like I got so many ideas for myself, too.”

The liaisons who participated in the lab day found the learning experience to be very worthwhile: “Definitely the lab day was hands down the most powerful part of the whole liaison piece for me.” Another described the lab day as the best part of the experience for them: “A smaller group setting with educators being able to have those conversations was beneficial. I just saw a lot of personal growth that day.” The lab day allowed for more intimate conversations due to the size of the group. This smaller group size seemed to prompt conversations and deeper thinking about teaching and learning: “I liked working with the other teachers from my grade level that day.”

In addition to the fact the liaisons had time to engage in professional conversations during the lab day, they also found value in the other activities they engaged in. Liaisons collectively watched two videos and engaged in conversations regarding the effective teaching strategies they observed. Then, each liaison shared a short video clip of their classroom with another liaison. The liaisons were paired based on the common effective teaching practice they chose to focus on. “Seeing other videos was great. I took a lot away from the video the other teacher I was paired with shared that day, as well as the other videos you showed,” one liaison said. The liaisons appreciated seeing the practices in action through the use of classroom videos on the lab day.

Professional Development-Leadership

The liaisons appreciated having time to apply what they were learning to their own practice. “I think just the classroom experience in doing it” was how one liaison described how they valued the time for application of their new learning. Being able to transfer the new knowledge learned to their own practice, allowed liaisons to strengthen their pedagogical skills and gain confidence in their own teaching of mathematics.

One liaison described how their leadership was validated while helping them put focus on aspects of leadership that could be changed or refined:

> My experience with math liaison kind of presented me with a lot of opportunities that helped me grow as a teacher leader in mathematics. Those were some good opportunities to validate what I’m already doing is working. I already have these great things in place and then taking the things that maybe need tweaking or enhanced and really focusing on those.

Participating as a liaison prompted a number of liaisons to make a shift in their thinking regarding leadership. This shift involved originally viewing leadership as being directed by an outside influence to post-experience being directed from within themselves. “I feel like I kind of got my mind changed where like this doesn’t have to be something that someone needs to say,” commented one liaison. The liaison experience, specifically the activity that focused on different types of leadership, helped the teacher leader realize that leadership does not have to be something someone else asks one to do. Rather, leaders self-direct.

Some liaisons commented they wished there were more structure in regard to leadership strategies during the liaison experience: “We talked about and shared a lot of

ideas about how to grow in leadership, but I almost think I would have had to be something like you need to do." These liaisons sought a directive, or assignment, to provide motivation and/or encouragement to step out of their comfort zone and explore new leadership opportunities.

Participants felt by participating as a liaison, they were presented with an opportunity to step aside from solely working with colleagues in their building and broaden their professional networks. "I'm working with other teachers in the district which we don't always get the opportunity to do," said one liaison. Working with other liaisons from across the district presented opportunities for liaisons to collaborate and learn from one another. The liaisons discussed aspects of leadership, received feedback and suggestions, and developed an extended professional network.

Generally speaking, most liaisons upon completion of the liaison experience wanted to continue growing as leaders through the pursuit of additional professional development opportunities. One liaison shared they would take additional courses offered by the district: "I want to take that math class to get a deeper understanding and listen to other people talk about math and how they do things." Another liaison considered pursuing leadership in a more formal way: "I would like to go back to graduate school and focus on teacher leadership."

Teacher Leadership

Roles, Beliefs, and Opportunities

Several liaisons desired to not to only improve their own practice but also the practice of others. The liaisons felt it was their job to hold others accountable regarding utilizing effective mathematics practices. One liaison stated, "I'm able to hold others

accountable while holding myself accountable as well." This liaison believed it was their duty to improve their own practice and encouraged others to do the same. "When we do our math planning, I am looking ahead and holding my team accountable for our students," said one liaison about their role during collaborative planning. They sensed it was their job to make sure the focus on the planning was on the effective teaching practices rather than aspects of the lesson that did not have as much impact on student learning: "I grew a lot closer with my team because we were able to have really critical conversations." This liaison sensed the tough conversations they initiated were not easy; however, they would strengthen the team as a whole.

Liaisons sensed their work as leaders shifted from building relationships with students to building relationships with other staff members. "I moved forward and thought about focusing on relationships with other teams and how I could help them," said one liaison about how their work moved from developing relationships in the classroom to beyond the classroom. One liaison shared they had a responsibility to not only reach out to others but also to nudge them to grow: "This year as a math liaison it's really helped me see as a teacher leader I need to be able to reach out to other teams to discuss mathematics. I need to have conversations to help them see what we are doing in my grade level so they can build upon that."

Liaisons voiced how their comfort with working with other leaders became stronger as a result of being a liaison. One liaison spoke specifically about how they had become more comfortable reaching out to district mathematics leaders. "I'm not so scared to reach out and email right now," they said, as they described their comfort level with approaching leaders who were housed at the district office. Another liaison shared

insight regarding their work with the instructional coach that worked in their building: “I feel like I work closer with the instructional coach and in different ways.” Perhaps becoming more comfortable working with other leaders stemmed from the fact that the liaisons were able to get to know the other leaders through their work over the year. Or, this comfort may have been due to liaisons having more confidence in their own abilities as a leader; therefore, they felt more at ease when collaborating with other leaders.

Exhibiting leadership in a broader setting allowed several liaisons to see themselves as a leader. “I think other people in the building recognize that I’m willing to go out on a limb and try something new as well as put myself into a vulnerable position,” said one liaison about presenting in front of their staff. As a result, the liaison saw themself more as a leader as well. One liaison spoke about how others saw them more as a leader after they shared a resource at a staff meeting: “I also feel like maybe there’s some people in the building that kind of look at me differently, especially after I did that staff meeting. I feel like I’m maybe seen as more of a leader in math.” One other liaison stated, “After I presented, I’ve been able to take on that leadership role a little bit more.” Not only did these experiences make the liaison’s work as a leader more public, but they also allowed the liaisons to view themselves more as a leader.

Due to their experience as liaisons, the teachers felt their own skills as a teacher had improved. In turn, they felt more confident as a leader of mathematics. “My teaching has improved so much,” said one liaison about the year. Another liaison shared similar thoughts: “I feel a lot more confident in my understanding of the curriculum. I feel more empowered to talk about mathematics. My overall confidence has grown.” Not only has the liaison’s belief in their own abilities regarding mathematics education developed, but

the liaison's confidence in their own abilities as a leader also have grown. "I want to take more opportunities to reach out to more people on staff as I have resources I can share," a liaison said.

Some liaisons recognized that the work of a leader is not always smooth or going to go as expected. A liaison said,

> My leadership journey has been a bit of a roller coaster. It's going great, and I think it's going good, and then I realize it wasn't as good as I thought. But you keep learning and keep applying what you know and it gets better.

Teacher leadership has its ups and downs and part of being a leader is recognizing these moments. One liaison shared, "I'm more of a quieter leader at times. I feel maybe I shouldn't be too much or too overpowering." This liaison sensed there were times they would exhibit more public leadership, while there were others where they felt it was best to not exhibit bold leadership. One liaison spoke of an experience they had by saying, "I guess there was some resistance but I felt like it was a misunderstanding or they were perceiving what I was saying a bit differently." Leadership is unpredictable, and the liaisons are aware of the complexity of the role.

Being a leader involves taking risks. The liaisons recognized there were many times they needed to step outside of their comfort zone. "You have to be a risk taker and you have to be OK being uncomfortable to make that growth. You have to be put in an uncomfortable position to be able to grow from that," said one liaison as they described themself as a leader. A liaison felt comfortable taking risks as they knew it was in the students' best interest for them to do so: "It's not easy, I ask, 'Am I doing this right?' Am I thinking about myself? But it's not really about you at all. I ask questions because I

want to be doing what is best for students." A liaison shared how presenting in front of their staff was not easy to do but had good results: "I feel like stepping out in front of my entire staff and talking to them about something was another area where it was really uncomfortable but it ended up being a really good experience for me." Another liaison said, "You just need to be willing to be there and help out and be open and vulnerable to the people you are leading" as they shared how one of the parts of being a leader for them was being willing to engage in work with others that they did not anticipate. Even though the liaisons were not initially feeling secure about parts of their role as a liaison, they saw how taking risks was beneficial and a piece of being a leader.

The liaisons recognized that being a leader means also being a learner: "If I'm going into something where it's a learning opportunity for me, I want to make sure to ask myself 'What do I want to learn from this?'" One liaison described how they often reached out to other leaders to learn from them: "I'll talk to them about their general overall experience as well as get some pointers on what they thought was helpful and not so helpful." This liaison wanted to be more informed in aspects of leadership in addition to that of mathematics content and pedagogy. Another liaison talked about being a learner by saying, "I think it is always good to try new things and to have a breadth of experiences." These liaisons acknowledged that continuous learning is a critical aspect of being a leader.

Teacher leaders understand that being a leader means one often exceeds what is initially expected of a leader. "I just think like they're willing to go above and beyond. They're willing to do a bit extra. They improve what needs to be improved and continue what is going well," a liaison said. The liaisons shared they were willing to listen to the

concern of others, think about how they can impact change, and act to work toward the goal. The liaisons share they often think about what others would want to know. “I always think, what would I want to know as a new teacher in the district?” stated one liaison as they thought about the information and message they felt was important to convey to others. This liaison felt as though their colleagues in the buildings would not always ask the questions they had, so anticipating the questions they might ask was an important part of the liaison’s work as a leader. “You really need to be proactive and get out there and find ways to be a leader,” said a liaison as they discussed what they felt was important for being a leader.

Some liaisons believed that being chosen as a liaison, they were called to be a leader and something within them told them they needed to approach the role with a service-based mindset. “A leader needs to have a service-based mindset,” said one liaison. One liaison said,

> While leadership is a choice, I feel a sense of I was put in this position for a reason. Do I just do the bare minimum and sit here and let it happen or not? Because I think that if you are going to let yourself do that, you are not going to make as much growth as you should be. I feel as if some other liaisons were cheating themselves out of some good experiences that I was able to do.

This liaison describes how they felt compelled not to do the bare minimum but rather maximize the opportunities for learning for both themself and others. One liaison said, “I kind of realized this is something, not an obligation necessarily, but it makes me want to share it.” Another liaison said, “I feel like I kind of got my mind changed when I realized

this doesn't have to be something that someone needs to say" as they spoke about how they sensed responsibility to be a leader without being given a directive.

Many liaisons view leadership as a way of serving others. One liaison describes their work as a teacher leader as, "someone who is willing to serve first. I think as a leader you need to be willing to serve others, serving and giving your time to someone who needs it." The receiving end of this leadership may involve both students and colleagues. "I'm just doing what I know I should be doing for my students," one liaison said about how they feel leadership is a way to benefit students. This service is the extra work teachers do that goes beyond what is expected of them on a routine basis. One liaison often asks themself, "What else can we do as teachers? What can be changed in ourselves when we are teaching to help support them?" This liaison reflects on their own practice, as well as urges others, to think about how to best meet the needs of the students.

The liaisons shared a belief that leadership is about being willing to provide other teachers with information that they were learning about, as it would benefit a larger population of students across their respective buildings. One shared their feelings that it was not fair to keep the learning from the liaison experience to themself: "I feel like I have all these great things and it's like only sticking to my room right now." Another spoke to how their leadership could benefit a larger population of students: "I think about what I am doing that could benefit my building. What am I learning that could benefit other students? What can I bring to the table in this area of leadership?" The liaisons felt as they were in a position to help other teachers grow and learn. "How can I use this

position to help other people and use it in the right way?" one liaison asked themself, "otherwise, I feel kind of selfish."

One liaison spoke about how participating in the liaison experience upheld their beliefs about what teacher leadership should encompass:

> It's more affirmed my belief in what a leader should be. I think the math liaison role has really helped me see there are methods and strategies to teaching mathematics and that those ways have been tested and proved and that data really drives those decisions. It's really helped me get a grasp on the data and understand the data in a different way and really helped me grow as a math professional and helped me understand how to teach math in different ways. It's really just helping me build confidence in that area and it's allowed me to share more resources with my team. So, it's really just affirmed those beliefs.

Effective Teaching Practices

The liaisons appreciated the focus on the effective teaching practices from *Principles to Actions: Ensuring Mathematical Success for All* (NCTM, 2014) and *Taking Action: Implementing Effective Teaching Practices K–5* (Huinker & Bill, 2017). Most liaisons were unfamiliar with these resources prior to participating in the liaison experience. Also, some liaisons commented how the teaching strategies applied not only to mathematics, but also other content areas they taught. For example, one liaison embraced the idea that asking good questions is a pedagogical strategy that goes beyond mathematics:

> Mine went not only for math, but like every academic area. So like the purpose of questions, I started doing it more and then my students started asking more

> personal questions in reading. It kind of carried on to other academic areas, which was not intended.

Because the liaisons embraced the idea that the effective teaching practices were applicable beyond mathematics, one might theorize they had more buy-in than they may have without having these connections.

Liaisons appreciated studying the effective teaching practices, especially that they were asked to focus on one of the effective teaching practices. One liaison said,

> I liked that we focused on one area and I feel like that was more realistic for me with everything else going on in our lives. I do feel like I had a lot of strong growth in that one area and I'm so much more knowledgeable about that.

Another liaison shared a similar statement: "Setting the goal and then creating a plan of how I was going to achieve that goal was really helpful. I do like that I was able to focus on one thing versus a lot of things." Pinpointing one effective teaching practice allowed liaisons to have a clear vision for their learning, as focusing on one idea versus many seemed to be advantageous.

An overwhelming majority of the liaisons chose productive struggle and purposeful questioning as the two effective teaching practices they wanted to focus on. Of the six liaisons who were a part of the focus group, two liaisons chose productive struggle and the others chose questioning. Liaisons stated having a focus allowed them to focus on one area, but came to realize the effective teaching practices were related: "It didn't overwhelm me at first as I knew I was just going to work on one thing. But in the end, I really improved in all of the practices because they're so integrated with each

other." One liaison did not realize the impact their focus on purposeful questioning would have on other effective teaching practices:

> I did purposeful questioning and it just dawned on me that through just focusing on questioning, I really hit a lot of the other ones as well. Honestly, I hadn't realized that until I was just answering that question for you.

Even though the liaisons chose one area of focus, they realized their improvement in other areas was due to the integrated nature of the effective teaching practices.

Liaisons appreciated the time they were given to collaborate with other liaisons who chose the same effective teaching practice. The liaisons met in groups related to the teaching practice they chose during the second and third liaison meetings. They met in this similar manner during the lab day as well. One liaison said,

> I really enjoyed being able to have conversations centered around math with other teachers at my grade level as well as other grade levels. I was really able to have deep conversations with others and then bring some aspects of those deep conversations back to my own building.

These conversations helped liaisons develop a deeper understanding of the effective teaching practice they chose and discuss what they implemented in their classrooms as a result of their learning.

The liaisons found the resources given to them, which centered on the effective teaching strategies, as valuable. "I thought the texts you gave us were very, very helpful," a liaison said when referencing the two texts each liaison received as a part of the experience. "I really appreciated the second book," said one liaison, speaking specifically about *Taking Action: Implementing Effective Teaching Practices K–5* (Huinker & Bill,

2017). The liaisons found the vignettes and classroom examples useful: “I think it was easy to relate what my students were doing and what they were doing in the book. There were parallel connections.” Another liaison felt similarly, “I could see my students in the students. I got so many ideas and when my students were working on a task, I would find myself thinking back to the case studies and how the teacher responded.” The vignettes and classroom examples brought learning to life for the liaisons as they were able to relate to the situations. The learning transferred to the liaison’s own practice as a result.

Many liaisons found the information from the resources valuable, which compelled them to share with their peers. One liaison sent an email to their entire staff that included information on different types of questioning. This liaison shared their newly gained knowledge of purposeful questioning as they believed it was closely connected to the building’s school improvement goal. Two other liaisons copied a chart from one of the books and distributed the charts to their entire staff:

> I gave the chart to my staff and challenged them to think about what types of questions they were asking. Or I gave them the option to plan five questions in advance of teaching a lesson as it is so important.

These liaisons felt confident about their new learning, therefore they provided opportunities for others to learn through their actions of sharing information. The liaisons also nudged their colleagues to think about aspects of their own teaching of mathematics.

Many math liaisons felt diving in deep in regard to one effective teaching practice not only benefited their own practice, but also those they worked with. While speaking about their team meetings, one liaison said, “We had professional development built in and incorporated this into our planning.” Another liaison commented on how they could

infuse elements of the effective teaching practice into the conversations their team had while planning. “When we collaboratively plan math lessons, we’ll use things from there as well. It helps us look at the types of questions we ask in our lessons and how we can make the lessons more conceptual,” this liaison said. One liaison shared their team talked about a particular effective teaching practice and thought about how this practice related to their own teaching: “We’ve kind of started moving toward the instruction part of it now.” By sharing their knowledge gained of effective teaching practices, the liaisons applied their new learning to the everyday work of their team.

Learning about one specific effective teaching practice created a self-awareness in the math liaisons. They began to think about their own practice as a result and made refinements to be more aligned with the ideas housed within the effective teaching practice. “I had a chance to really reflect on my own teaching” shared one liaison as they described the impact their learning as a liaison had on their daily practice. One liaison admitted, “I just wasn’t giving the time to questioning that I should have been.” Another liaison added, “I just dove into productive struggle and made sure I wasn’t helping them right away. It really helped with their confidence.”

Liaisons felt they had a new abundance of knowledge as a result of studying one effective teaching practice. Once the liaisons gained a deeper understanding of the topic, they realized they might be already doing some things related to the practice in their respective classrooms and could build upon these aspects. One liaison said,

> I didn’t really feel like I fully understood what it meant. I wasn’t even aware that I was already using it at times. I feel like I’m a lot more confident now because I have all of these tools that I can use to build upon what I’m already doing.

Another liaison shared, “I felt a lot more confident in my understanding of mathematics after learning more about it. I felt more empowered to talk about mathematics.” This liaison’s understanding of mathematics was deepened through their study of the practices. This new “knowledge bank” of effective teaching strategies appeared to be useful for the liaisons, as they could draw upon it when advocating for effective mathematics instruction in their respective buildings.

Identity

Leader

A number of math liaisons did not self-identify as leaders when they began the liaison experience. “I never before would have pictured myself taking on a math leadership role because of my past experiences,” commented one of the liaisons. Many liaisons felt comfortable using words such as learner, organized, and trustworthy to describe themselves but failed to include the word leader. Even though many liaisons may not have viewed themselves as leaders, they described the many characteristics foundational to leadership.

“I don’t even know what my problem with the word leader is,” declared one liaison as they described how they were uncomfortable with being recognized as a leader. The liaison added,

> It’s funny because people tell me that I am a leader and I tell them I’m just doing my job. The word leader is a weird term for me because I’m just doing what I know I should be doing and what is best for students. Well, I guess that is a kind of a leader.

This liaison views leadership as an obligation or sense of service rather than something they were told to do. They see being a leader as an aspect that falls with the scope of their regular teaching duties.

Some liaisons started to feel more like a leader as they began to share the resources and knowledge they gained with other members of their staff. “I started the leading process by inviting people into my room and putting myself out of my comfort zone,” one liaison said. One liaison felt more like a leader when they sent an email to staff members encouraging them to think about teaching mathematics in a slightly different way. Another liaison viewed their own leadership as sharing knowledge with other leaders on the staff to help them get a clearer view of effective mathematics instruction. These liaisons viewed their own leadership through their own actions.

Two liaisons shared they felt more like a leader of mathematics once they stood in front of the other teachers in their building during a staff meeting. Both liaisons tried something new, as they presented to their respective large groups. “Stepping outside of my comfort zone is something I’m not always ready to do but there was this moment where I was like, I just have to,” one liaison said. These liaisons believed standing in front of their staff helped shape their own thoughts about themselves as leaders and also helped shape their peers’ thoughts about them as leaders. “Some people in the building kind of look at me differently, especially after I did that,” one liaison said. Another liaison said, “I think they see me as somebody that is a leader in that area once I shared at the staff meeting.” These liaisons recognize that even though the experience was uncomfortable, it was worthwhile in the end for a number of reasons.

Some liaisons believe that due to the participation in the yearlong experience, they became more confident and viewed themselves more as a leader: “I feel like I’m more confident just due to the fact I was asked to be a math liaison.” Other liaisons shared their confidence came from being vulnerable as a teacher leader: “I feel like that is where I have to be pushed into doing things. You have to be comfortable being put into uncomfortable positions to be able to grow from them.” As these liaisons accepted these feelings of uneasiness, they began to feel more confident as a leader. One liaison said, “It’s not because it is easy. I think I got caught in thinking, ‘Am I doing this right?’ But it’s not really about you at all.”

Once the liaisons gained more confidence in their own leadership, they perceived themselves as leaders and became more willing to work with other teachers in their building in regard to mathematics. “I want to take more opportunities to reach out to more people on my staff. I think my overall confidence was strengthened,” one liaison said. Another liaison felt that by gaining new resources, they were willing to take on the role of a leader in regard to mathematics on their team: “So it’s really just helping me build my confidence and it’s allowed me to share more resources with my team.” Other liaisons began to believe they could exhibit leadership beyond their team: “I feel a sense of comfort where I can go to another grade and ask, “Have you thought about this before or have you done that?’”

The liaisons believed that serving as the mathematics liaison for their building was not something they were doing for themselves, but rather for others. They self-identified more as leaders as they viewed their service to others as important. “I kind of got my mind changed where like this doesn’t have to be something that someone needs to

tell you what to do," said one liaison about their shift in thinking regarding leadership. "You're in this position for a reason and you need to kind of recognize that. I asked myself, 'Why am I in this position? How can I use this position to help other people?'" One liaison described that they felt it was their duty to be a leader: "I kind of got to this point that it felt like it was not an obligation but I felt like it was something that I needed to do."

Learner

When asked to use three words to describe themselves, five of the six math liaisons who were interviewed used the word "learner." These liaisons recognize this attribute contributes to their success as an educator. One liaison specifically said,

> A teacher is always a learner. I feel like I'm always learning. I have the opportunity to teach some great students, and I think I'm learning a lot more from them than I'm necessarily teaching them. I feel it is a gift to be a teacher, and I feel like I'm constantly learning in and outside of the classroom.

A common theme among the liaisons appears they experienced productive struggle in mathematics at some point of their own educational journey. One liaison described their experience in this way, "I was just overall horrible at math and there was no teaching me when it came to mathematics. I had very low confidence in the subject until I got to college." Others shared, "I hated math because I didn't understand it," and, "from that point I always felt like I'm not very good at it because I was kind of a struggler." One liaison described their elementary experience in this way,

> We had a medium, high, and low math class. I feel like that really took a tremendous effect on my view of myself as a math student. I was not very strong in math so I was always in what you consider as the low, slow group.

Negative experiences such as the ones liaisons described, may cause anxiety and self-doubt in one's abilities as a student and their work as a teacher of mathematics.

Many liaisons believe past experiences as a learner impacted how they approached the liaison experience. "I really put myself out of my comfort zone," describes one liaison about taking risks and learning something new. Being vulnerable and uncomfortable, while also experiencing disequilibrium, contributes to new learning. The liaisons sensed they needed to take these risks in order to be the best teacher of mathematics they could be. "Being put into an uncomfortable position will make you grow. And I feel like doing this I was able to really reflect on what I'm doing myself as a teacher and make tweaks, even if they are just little tweaks," said one liaison. The liaisons recognize that being willing to take risks and be vulnerable are important aspects of being a learner.

After diving into mathematics pedagogy through the liaison experience, many liaisons expressed interest in continuing their learning journey beyond what was expected as a liaison. It appeared as if the more they learned about mathematics, the more they realized there was to learn. "I've got quite a few things that I want to do next year," declared one liaison as they spoke about extending their learning into the future. "I want to continue to use the texts that you guys provided for us," commented another liaison as they explained that they wanted to become more familiar with the other effective teaching practices that they did not explore in-depth. A liaison added, "I don't really want

to stop my progress that I've been working on this year with productive struggle. I would like to continue to work on that and also make a new goal, such as a different instructional strategy." The liaisons did not view their learning journey as coming to an end as the liaison experience ended. Rather, they sought to build upon their learning on their own.

Some liaisons were compelled to explore additional learning opportunities in mathematics as a result of being a liaison. "I think I'd like to challenge myself to do something that supports me and myself as a learner of math," one liaison shared as they spoke about plans for themself as a learner. Liaisons were looking for additional texts or resources to contribute to their learning of mathematics pedagogy. "I am going to try to get re-energized again about math," said one liaison who had participated in extensive learning about mathematics prior to being a liaison. Others sought more formal professional learning opportunities. "I think I'm going to look for other opportunities to grow," shared a liaison. "I'm going to take the class you are offering to get a deeper understanding of mathematics." Another liaison commented,

> I'm definitely more willing to go to math professional development sessions next year, as my team has kind of steered toward literacy in the past but it would be nice to go to some math ones to see how I can improve.

Participating as a liaison seemed to renew the liaison's interest in learning about mathematics or spark those liaisons who had not explored mathematics in the past.

The majority of the liaisons felt they needed to be self-motivated when it came to continuing the learning about mathematics that they began as a liaison: "To expand your knowledge base, you really just need to be proactive about it." One liaison believes one's

learning must be self-initiated: “I think ultimately you need to be proactive and you need to look for those opportunities outside of the regularly scheduled hours to grow in your understanding.” The liaisons realize a learner needs to be driven to explore other opportunities, as many of the leadership opportunities are not included as a requirement of their job.

Student Achievement

Student achievement did not surface during the interviews or other data collection. This may have been due to the fact that student learning remained a distal outcome from the liaison’s initial learning about pedagogy. The timeline of the liaison experience did not necessarily allow for the liaisons to learn about an effective teaching practice, implement the strategy in their respective classroom, and see significant changes in student data results. Student achievement was not the focus of the liaison experience; rather, it was on teacher learning. While student achievement may be the ultimate goal for teacher leadership, achievement was too far removed from the liaisons’ work during the liaison experience. This initial category resulted in a lack of data because it was not the main focus of the investigation, I did not analyze the student achievement data that was gathered during the duration of the study.

Math Liaison Experience

There were many components to the liaison experience. Through the interviews and other information conversations, liaisons addressed these components and how they felt each component contributed to their learning and leadership. “I really appreciated

how liaisons was more of a staff development than receiving information to share with my school. I feel as it was a better use of our time," one liaison said.

The liaisons appreciated the resources and opportunities they were given as a participant in the liaison experience. "We got a lot of really amazing materials and were given opportunities for a lot of really great personal growth," said one liaison. The textbooks, *Principles to Actions: Ensuring Mathematical Success for All* (NCTM, 2014) and *Taking Action: Effective Teaching Practices for Grades K–5* (2017), were highly valued by the liaisons. "I thought the texts you gave us were also very, very helpful. They were helpful components," said one liaison as they spoke about the two books. One reason the liaisons may have found these to be beneficial is due to the fact they were applicable to their classrooms: "I'm not one to really enjoy textbooks but I felt like they kind of hit home in a lot of different concepts." *Taking Action: Effective Teaching Practices for Grades K–5* (2017) appeared to be the book that was most valued. "I appreciated the second book, *Taking Action*," stated a liaison. "It was good. It was a nice companion to the other one." The liaisons found these resources to be beneficial, enough so that they wanted to continue reading from the book after the liaison experience had ended. "I want to continue to use the texts you provided," said one liaison as they spoke about wanting to read a different chapter than they were asked to during the liaison experience.

Not only did the liaisons appreciate the texts but also other components of the experience. "Having time to write that math story," one said as they shared what they felt was one of the best parts of the experience. Other liaisons spoke about having a district teacher leader visit a classroom and provide feedback on a lesson. While this was a

choice given to the liaisons, a number took advantage of this opportunity, which allowed them to think about their own individual practices. One liaison videoed themself teaching lessons and said they watched it by closely examining their own practice. “I feel as if having time for reflection was really helpful,” said one liaison as they described what they found to be most beneficial. Another said, ‘I enjoyed the chance to really reflect on my own teaching to do well.” Having time to think about their own practice was welcomed and contributed to the success of the liaisons.

One aspect the liaisons said was most beneficial was the fact they developed stronger professional relationships with other teachers from across the district. “It was a really good experience because I stepped aside from working within our building to work with other teachers in the district, which we don’t always get the opportunity to do.” The liaisons seemed to appreciate being able to have time to talk with other liaisons about their celebrations and challenges of teaching mathematics. “It was nice to be around another group of educators, as it is easy to get stuck in your own building’s bubble,” said a liaison who appreciated getting the chance to talk with others about teaching and learning mathematics. This time to converse with colleagues seemed to be highly valued. “I got back into some of those conversations that I feel like I’ve been out of that for a while, and I’ve missed it,” said one liaison as they described how their opportunities to have conversations about teaching and learning mathematics were not as plentiful at their building as they once were.

While the liaisons appreciated the time they spent discussing aspects of teaching mathematics in mixed groups, they expressed they valued the time they spent in grade-level groups as well. One liaison said,

> I really enjoyed being able to have conversations centered around math with other teachers at my grade level as well as other grade levels. I feel like here at my building, we have those conversations but they are not as frequent.

Another liaison had similar feelings about the conversations:

> One thing I especially liked was when I got to talk to someone who teaches the same level. It was nice when I got paired with another first-grade teacher. It was so nice when you share those experiences with someone who was going through the exact same thing that you are.

There are not a lot of opportunities for teachers from different buildings to come together to discuss aspects of teaching mathematics, so the liaison experience provided an opportunity for them to do so.

Liaisons were asked to engage in a self-assessment of the effective teaching practices and determine which practice they felt they had the most room for growth in. In turn, this practice would be the one they would be asked to focus on for the duration of their liaison experience. “I liked setting the goal and creating a plan of how we were going to achieve that goal. I liked that we focused on one thing versus a lot of things,” one liaison said. The liaisons seemed to appreciate being asked to focus on one effective teaching practice rather than multiple practices. One liaison felt focusing on one thing was a doable task:

> I like that we focused on one area as I feel that was just more realistic for me with everything else that’s going on. I do feel like I had a lot of growth in that area, and I’m so much more knowledgeable about it.

The liaisons were not overwhelmed because they did not have to read the entire book. Rather, they could tackle one part.

The liaisons found success in focusing on one of the effective teaching practices: "I learned about productive struggle this year in the text and gained so much valuable information regarding this practice. It was fun taking this information and sharing it with my staff about what I knew about productive struggle." This liaison found the information to be so valuable that they felt it was worthy of sharing it with their colleagues. Another liaison said that even though they focused on one thing, they saw improvement in other areas as well: "I was just going to work on this one practice but in the end, I saw improvements in other things because they are so integrated with each other."

Although the liaisons focused on one effective teaching practice, they desired to extend their learning and learn about other practices. Many spoke about how they desired to continue their learning by reading other chapters beyond the one they chose to read for the liaison experience. "I had a lot of growth in that area and now I'm thinking since I tackled this practice this year, I'm going to continue to do this," a liaison said. This liaison saw value in taking a deep dive into one practice at a time and plans to continue this process once the liaison experience has concluded.

The liaisons appreciated the opportunity to become more knowledgeable about effective teaching practices over the course of the year. One liaison shared, "The impact over a greater amount of the school year had a huge positive to what we've been working on." The extended time to focus on the effective teaching practice was beneficial. "It's more about growing yourself professionally and you know, growing in a leadership

position," this liaison added. This growth may not have been possible during a shorter duration of time.

One liaison shared that having assignments to complete over the course of the year as part of the expectation of being a liaison kept them accountable. However, these assignments often nudged the liaisons to grow in a way they may not have been encouraged to explore on their own. "Being put into an uncomfortable position will make you grow," said one liaison as they spoke about the assignments given to them. However, many liaisons equated the uncomfortableness with learning. "That uncomfortable position does make you learn and grow from that. It isn't taking the easy way out," another liaison said. The assignments were intended to encourage the liaisons to try something new in relation to teaching mathematics and most recognized this distinction.

Liaisons were able to be released from their regular classroom duties for one day to participate in a liaison lab day. Participation in this day was optional. Most liaisons who chose to participate in the lab day felt it was one of the best things about being a liaison. One liaison said,

> Definitely the lab day was hands down the most powerful part of the whole liaison experience. It really renewed the teacher piece for me. Getting to have those deep, hard conversations with really great teachers just was like that shot in the arm I needed.

Another liaison felt re-energized from participating as well:

> The lab day you offered was really amazing. It was nice to have the whole day with the same group of peers to discuss math and be vulnerable when talking

> about some harder topics. I really left that day rejuvenated not just about math but about school in general.

Liaisons appreciated the fact they could put regular classroom duties aside for a day and focus their thinking on topics related to effective mathematics teaching and learning.

Liaisons commented many times about how they appreciated making deeper connections with the other liaisons who attended. “I felt it was a really good working relationship the day of the lab,” said one liaison as they described the day. The liaisons appreciated time spent both in grade-level groups and in groups that centered on the same effective teaching practice. Some liaisons felt it was most beneficial to have time to develop relationships with the other liaisons:

> On the lab day, I thought it was fun to meet some of the other teachers. And although I haven’t reached out or I haven’t been in contact with them since then, it’s nice to know a familiar face. I probably won’t remember their names, but their faces I will and when I go to meetings now I will know a few more people.

While the lab day did not establish deep bonds between participants, it created new relationships that may grow in the future.

When asked about what their favorite part of the lab day was, the liaisons provided many different answers. One liaison appreciated watching the videos from classrooms from both outside and inside the district: “Even though the video was from another grade level, I took a lot away from that video by watching the teachers.” Another found the conversation on equity to be valuable: “I think talking about equity gave me another lens to look at as a teacher with my students. So that was a powerful thing.” While the liaisons did not necessarily agree on their favorite parts of the lab day, many

spoke to the fact they enjoyed the smaller setting and conversations. “The smaller group setting with educators allowed us to have those conversations. I saw a lot of personal growth that day and just like kind of programmed my own thinking,” said one liaison. In addition, the liaisons felt they had experienced growth as a teacher of mathematics due to the lab day.

Even though the liaisons’ experience came to an end at the conclusion of the school year, many liaisons had plans to continue the work they started through participating in the experience. One liaison said, “I hope to get in touch with the math liaison for next year because I want to continue to grow in my understanding of mathematics and how to teach mathematics.” Another shared their plans of continuing their learning:

> I want to work with the new liaison because I don’t really want to stop my progress that I’ve been working on this year with productive struggle. I would like to continue working on that and also try to make a new goal, like trying out a different instructional strategy.

This liaison wants to continue the progress they made toward the goal with one effective teaching practice and plans to work with the new liaison and pick up another practice to focus on.

Two liaisons spoke specifically about how they desired to apply their leadership by working with the person who would be chosen as the next liaison from their building. “It’s almost like acting as a mentor to that person in your building. Whether it is setting aside some time to talk to them about whatever they talk about or just connect in that way.” A different liaison viewed the opportunity to collaborate with the new liaison:

"Next year, whoever is our liaison, I can work with them. Maybe we can do some back to school stuff, like a half-day session or questioning something." These liaisons saw potential in developing a relationship with the person selected as the new liaison and were thinking of ways they may come together as leaders.

The liaisons shared their positive feelings about the entire liaison experience. "I really enjoyed my experience this year as a math liaison," declared one liaison. Another stated,

> I loved the math liaison position. I think how it was set up and how it functions is highly beneficial and it is a great way to grow in mathematics as well as leadership. It was a great opportunity and honestly, I have no regrets about doing it. It was an excellent opportunity and I'm going to miss it for sure.

One spoke to how they felt the experience was worthwhile:

> It's been amazing. It was a really good six months. I think anytime we can get people together to talk about what we do and have conversations about the reality of what is happening is good. Anytime we can get educators together to talk about education, great things are going to happen.

Another liaison shared the same feelings and said, "I just enjoyed it. It's been a great learning year for me. I'd be interested in any future math liaison learning." Overall, the liaisons found the experience to be enjoyable and worthwhile.

Summary of Codes

Themes emerged as I analyzed the eight a priori codes. Liaisons appreciated having the chance to grow professionally. They attributed much of this growth to the professional resources they received. The liaisons appreciated the self-directed nature of

the liaison experience, as they felt navigating their own learning journeys allowed them to focus on specific needs and interests. Additionally, the liaisons felt leadership was a responsibility, but did not self-identify as a leader. These themes, along with the big ideas that surfaced during the analysis of the liaisons' interview responses, provided adequate information for me to answer my two research questions.

Findings Related to RQ_1

In Chapter 2, I discussed how there is little research on teacher leadership in the primary grades and mathematics. The research on teacher leadership is general in nature as the discipline of mathematics did not play a major role in the findings of the four studies that looked specifically at teacher leadership within the context of mathematics. Only one research study sought to learn more about teacher leadership within mathematics at the primary levels. These shortcomings in the literature, along with my personal interest, motivated me to gain more insight into the intersection of teacher leadership, mathematics pedagogy, and primary aged children's learning. I developed my two research questions to obtain a greater understanding of the opportunities and contextual factors that K–2 teacher leaders feel contribute to their growth as teacher leaders in mathematics and learn more about how a structured professional learning promotes leadership within K–2 teachers.

In this section, I will examine my findings in relation to my first research question, *What opportunities and contextual factors do K–2 teacher leaders identify as contributing to their growth as teacher leaders in mathematics?* The liaisons who participated as the focus group shared aspects of their personal journeys, and several themes emerged in regard to teacher leadership.

Overall, teacher leaders at the primary level identified the opportunities and contextual factors that contribute to their growth as teacher leaders of mathematics. Findings suggest primary teacher leaders in mathematics education generally have a personal experience with productive struggle. One's experience as a learner of mathematics seems to influence the actions of a leader. Having supportive administrators seemed to have an impact on the work of a teacher leader. The liaisons shared insights into their own stories, which highlighted the strong relationship they had with the educational leaders within their building. Personal experiences and relationships seem to matter in the work of a primary teacher leader in mathematics.

Two other themes emerged through this study in relation to opportunities and contextual factors that contributed to the liaison's leadership. One of these factors is that the liaisons collectively defined teacher leadership in a positive way. The liaisons hold a common belief that teacher leadership is worthwhile and critical for the success of the students they serve. In addition to seeing the benefits of teacher leadership, the liaisons came to view themselves as leaders over time. The liaisons identified as leaders, which impacts the work of a teacher leader.

Here, I will provide greater insights into the findings of what opportunities and contextual factors are important in the work of teacher leaders at the primary level. I will discuss the findings in these contexts and share relevant quotations from the liaisons to provide a richer picture of their personal experiences with productive struggle, supportive administrators, views of general leadership, and personal views of their own leadership.

Personal Experience Navigating Productive Struggle in Mathematics

Most liaisons experienced a time in their own lives where math did not come easy to them. Five out of six liaisons spoke directly of a time in their personal lives where they experienced learning challenges in mathematics. The difficulties in mathematics played a role in how they viewed themselves as learners of mathematics. Although the liaisons experienced struggle, each of the liaisons was able to overcome their difficulties and experience success at some point. These personal accounts with productive struggle seem to have an impact on the liaisons' approach to teaching mathematics. It is as if these accounts helped the liaisons understand the power in productive struggle. Additionally, these experiences seem to provide a "why" the teachers have pursued leadership in mathematics. Whether it was a turning point where they began to see math as worthwhile or a time when they realized math was something they can do, these experiences provided a context for the liaisons where they gained confidence in their own abilities as a learner of mathematics. Perhaps these experiences allow the liaisons to experience success in the subject and provide an internal motivation for them to help all students they work with have the same type of success.

Struggling in mathematics began in elementary school for two of the liaisons. Taylor's struggles began in fourth grade: "In fourth grade, I tested into high math. I don't know how, as when I got there I did not understand what was happening. I struggled from that point on." Vaughn also spoke of struggling with math in elementary school and being assigned to a low math group: "I feel like that really took a tremendous effect on my view of myself as a math student. I was not very strong in math." These two liaisons encountered trying times in mathematics as young learners.

Three liaisons said they confronted productive struggle as learners of mathematics but did not experience this struggle until late middle school or high school. Avery shared recollections of their experiences as a middle school student who was put in an accelerated course: “I felt everyone else got it and like I really wasn’t supposed to be there. And so it was just kind of a struggle and I always thought I was pretty good with math until that point.” Alex encountered difficulties in mathematics during middle school as well. Alex shared recollections of being placed in eighth grade Algebra without having the pre-Algebra as a prerequisite: “It was probably one of the first times where I, in school, really felt like I was a struggler and not getting it.” Corey came upon trying times in mathematics as a high school student: “When I got to high school I kind of hit a slump, and it was harder for me and I didn’t feel very supported.” While all of these three liaisons felt successful as learners of mathematics early in their mathematical journeys, they ran into roadblocks as more mature students.

The liaisons who felt mathematics was not always easy for them spoke to the turning point in their personal journeys where they gained confidence as learners of mathematics. Most often, it was years after the liaisons lost confidence in their own mathematical abilities that the liaisons started to view mathematics through a different lens. The turning points occurred in high school for some liaisons, and in college for others. Vaughn attributes their success in mathematics to two high school teachers: “I feel like she [geometry teacher] helped me figure out what my view on math is more about. It’s not about whether you’re smart or not smart but it is about having a growth mindset.” Vaughn added thoughts about the second teacher who “helped me see that yes, I can do the math because of hard work and effort. It’s not whether you have it or you don’t.”

Three liaisons felt college professors were the teachers who helped them see mathematics in a way that made sense to them. Corey attributes their success to professors that helped them understand mathematics. Corey spoke of this turning point in their learning journey, “I found very supportive teachers that really walked us through how to teach math and how to understand math in general. And I realized that I was and could be good at math and that gave me a really strong confidence base.” Avery had a similar experience with a collegiate course and how it changed their outlook as a learner of mathematics:

> That was really the first math class since basically sixth grade since I actually enjoyed and felt like I was getting something out of it. That class really kind of turned a corner, you know, there’s a reason why that’s the answer not just because. That really kind of changed my whole look on math.

Taylor shared, “I finally found a way that worked for me when I was 20, then I could understand other ways of doing mathematics.”

The liaisons who overcame insecurities as learners of mathematics believe these experiences have influenced who they are as teachers and leaders of mathematics. The time Taylor spent not understanding the mathematical concepts affected their teaching as they did not want their students to not be able to understand mathematics. Alex also discussed how these experiences shaped who they are as a teacher and leader of mathematics: “It’s nice taking that aspect into my teaching where now I see that things don’t always come easy and seeing the other end of it, but also knowing sticking with it, it finally all came together and clicked.” Corey had similar thoughts about teaching due

to their past experiences: “This let me see that no one is bad at math. My students can be successful with the right teaching, tools, and strategies.”

Experiencing difficulties as learners of mathematics influenced the liaisons’ teaching of mathematics as well as their leadership in the subject. The liaisons feel strongly that what they went through as a learner of mathematics will affect both how they teach and lead others. Vaughn addressed specifically how their personal accounts as a learner of mathematics contributed to their leadership: “My experiences are probably why I’m advocate against certain things.”

The fact that mathematics did not always come easy for the liaisons seems to play a factor in the liaisons’ work as teacher leaders. Perhaps the liaisons have a personal conviction of wanting the students they work with to not experience the same type of negative feelings they had as a learner of mathematics. It might be that the liaisons know what it is to finally understand mathematics, and they want their students to do the same. Or it may be that these teacher leaders have a sense of what it takes to be successful in mathematics and want to help the students with which they work to feel the same type of accomplishment. Whatever the case, it appears navigating productive struggle as learners has contributed to the development of these liaisons as teacher leaders.

Supportive Administrators

One common thread all six liaisons spoke of was having strong relationships with building administrators. It did not seem to matter if the principal was new to the building or had been at that building for several years. Each of the six liaisons whom I interviewed as part of the focus group stated they felt the principal and/or assistant principal of their respective building was supportive of their work as teacher leaders. The liaisons

described the principals as both supportive and trusting and provided opportunities in which the liaisons could grow professionally.

Several math liaisons spoke of how the principals in their respective buildings were supportive of their work as teacher leaders. Vaughn described their connection with building administrators: “I feel like I have a really good relationship with them. They are really supportive.” Parker spoke succinctly of the leaders in their building: “Administration is here for support.” While these liaisons did not elaborate on the types of support they received from their building leaders, each spoke generally to how they viewed the leadership of their respective buildings.

A few of the liaison who were interviewed described the types of support they felt their principal or assistant principal provided. Corey mentioned the support they received from the leaders in their building in addition to the principal’s normal duties as an evaluator: “It is important to not only evaluate teachers but also support them with what they need.” The liaisons felt their administrators were supportive in that they provided encouragement when needed, gave advice when it was warranted, and listened to the liaison’s ideas or concerns. While speaking about their building leaders, Alex said, “Our administration is so supportive and they are very easy to work with.” The relationship between building administrators and teacher leaders should be one in which the teachers feel that the administrators can associate with the work of the teacher leader and are willing to provide what the teacher leader needs in order to be successful in their role.

Trust is having a firm belief in someone’s capabilities. The liaisons shared they feel it is important that trust is evident in their relationship with building leaders. This trust goes both ways, in that the liaison believes in the principal or assistant principal and

in return, the principal has trust in the liaison. Taylor simply described her relationship with their building leaders, “I really like them both. I trust them.” This trust had developed in a short time, as one of the leaders was in their first year in Taylor’s building. Taylor was surprised at how quickly this trust developed, but admitted they were a bit surprised due to the fact that the styles and personalities of the former and new principals were very different.

The fact that the principal has trust in the liaison is a factor in the teacher leader’s success. Avery shared similar sentiments as Taylor about trust when speaking about their principal: “…I think they are very trusting. They know you are going to do your job.” Avery values the fact that in their case, building leadership does not try to micromanage what happens in classrooms. Instead, the building leaders trust the teachers who work inside of their building’s walls and believe the teacher leaders will do their job to the best of their ability.

Trust is evident in other ways within the relationship of the building leader and liaison. Often, the principal values the expertise of the liaison, or teacher leader, as they bring knowledge about the subject area that the principal may not have themselves. The principal believes the liaison has insights, ideas, and thoughts about mathematics instruction that the principal might not have on their own. Building leaders cannot be experts in all subject areas, so often they look to their liaison for this content expertise. Alex shared, “They are receptive and when you have ideas or concerns, they take it to heart and a lot of times they will act on it.” Principals value the work of teacher leaders, as they understand it takes the work of more than one leader to craft a successful school.

Additionally, the liaisons felt their principals encouraged them to grow as a professional. Most likely this does not look the same for each liaison; however, many liaisons addressed how their building administrators found opportunities for the liaisons to learn and grow professionally. The opportunities principals presented varied as some took place within the classroom, while others were broader in scope.

Some of the opportunities the principals presented to the liaisons applied directly to the classroom. When speaking of the school principal, Taylor shared, "…I see her as my teacher." Taylor saw the building principal as someone who educated them about teaching practices and strategies. Corey viewed their principal in a similar way: "She [building principal] is both a teacher and an administrator. She has a good pulse of what classrooms should look like and feedback." Corey valued the fact that their principal has a wealth of knowledge about teaching and learning and pushes Corey to refine their own craft. Parker shared that their building principal often shares new learning resources, as the principal understands that Parker is constantly searching to learn more about effective instructional practices. Overall, the building leadership urged the liaisons to grow and reach toward greater excellence.

In addition to providing opportunities in the classroom, liaisons shared how their building principals presented situations in which the liaisons could expand upon their leadership capabilities beyond their own classroom. One liaison shared they were appointed by their principal to serve as the chairman of the school improvement committee. This school-wide committee leads the charge in instructional improvements and academic achievement for students. Becoming the chairman of a school-wide committee, Vaughn felt their principal believed in them and gained confidence as they

felt they had the leadership capabilities to lead one of the most important committees of the building. Avery shared an experience that contributed to their confidence as a leader. The building principal allowed Avery to have time during a staff meeting to share their learning about purposeful questioning with the entire staff. Avery shared this experience was instrumental in their leadership journey, as they gained confidence in their own capabilities, as well as helped their colleagues view them as a leader of mathematics within the building. Parker shared that due to the fact their principal chose them to be a liaison, or represent the building in a district-wide group, provided them with more belief in their own abilities. All these experiences provided by building leadership, allowed the liaisons to grow and develop in contexts beyond the four walls of their own classrooms.

Having a strong relationship with building administrators was one factor that contributed to the growth of teacher leaders. This relationship looked different for each liaison; however, there were common threads that surfaced. Liaisons felt supported by their principals and that the principals provided what the liaison needed both as a classroom teacher and teacher leader. Liaisons also felt it was important to have trust with their building leaders. This two-way trust between a liaison and principal was important to their relationship to be successful. Lastly, the liaisons spoke of how the principal encouraged the liaison to grow as a professional. Liaisons viewed the principals as their coaches, mentors, and cheerleaders. It did not matter if the work of the liaison happened within the classroom or building. What seemed to matter most was the strong, positive connection the liaison had with their building principal.

Positive View of Teacher Leadership

When asked, each of the six liaisons spoke of teacher leadership positively. While they all had personal views of what being a leader entails, one common thread was they view leadership in a favorable way. One factor that played a role in the liaison's growth as a teacher leader in mathematics is having the mindset that leadership is important and can contribute to growth. The liaisons each described what they feel teacher leadership should encompass. Collectively, these definitions come together to create a broader description of teacher leadership.

A teacher leader is one who is willing to serve others. Corey describes this by saying, "I think a teacher leader is someone who is willing to serve first. I think overall a leader needs to have a service-based mindset." Avery describes their view of service in this way:

> They're willing to go above and beyond, do a little extra. They'll hear all sides of what is going on, concerns, complaints, and just how they can make things better. They want to change to make things better and the best that it can be. So, improving what needs to be improved and continuing what is going well.

A teacher leader's willingness to serve others and help them improve is one factor that contributes to not only their own growth as leaders, but the growth of others as well.

The liaisons viewed teacher leaders as members of the school community who "... people can go to get advice and someone who can listen and share thoughts." Additionally, "someone who is knowledgeable and kind of just willing to be there and help out." Whether it is a listening ear, sharing content knowledge, or providing assistance when needed, teacher leaders do what it takes. To do this, the liaisons felt

teacher leaders need to work well with others, be prepared, and hold others accountable in addition to themselves.

Teacher leaders are willing to be vulnerable and try new things. This vulnerability may be in the context of instructional practices or other aspects of teaching. The liaisons spoke of how they felt this characteristic was an important aspect of being a successful teacher leader. “A teacher leader needs to be a risk taker, you have to be okay to be uncomfortable to make growth,” Vaughn said to describe their personal opinion of what teacher leaders should be. Vaughn felt teacher leaders should not be comfortable with the status quo and be willing to try new things for the betterment of their students, team, and school. Alex shared similar thoughts about what a teacher leader should be: “…be open and vulnerable to the people that you are leading.” Along with being vulnerable, teacher leaders often take initiative. “Somebody has to be the one that’s like we need to get together and figure this out,” said Taylor.

The liaisons spoke of teacher leadership in a way that leadership has the potential to help others grow and improve. They felt teacher leaders are willing to serve others and are available when colleagues need them. The liaisons felt teacher leaders do not play it safe, but rather take risks and are willing to display their vulnerability in a public way. Overall, the liaisons feel a teacher leader has the potential to create change both within themselves and others. This view of leadership is another contextual factor that is instrumental in the liaison’s growth as teacher leaders in mathematics.

Characterizes Self as a Leader

A final contextual factor that seemed to play an influential role in the growth of teacher leaders is their own perception of themselves as leaders. Most of the liaisons of

whom were interviewed shared thoughts about their own leadership. While the teacher leaders did not come out and overtly say, “I am a leader,” their descriptions of their own leadership allow one to assume that they recognized themselves as leaders or recognized they have leadership potential. Some of this self-recognition as a leader may have come from how the liaison felt others perceived them as leaders. In addition, mindset and belief in one’s own capabilities appeared to be factors that contributed to the liaison’s growth as teacher leaders.

Liaisons spoke of their own leadership in terms of how they feel others perceive them as leaders. This viewpoint may be the result of the liaison’s willingness to take risks on behalf of the greater population of staff or motivation to go above and beyond the routine duties of teaching. Some of the liaisons perceptions of their own leadership had to do with the fact the liaisons would engage in conversations about mathematics content and pedagogy. During an interview, Alex said, “They know they can come to me and talk with me. We’ll have those more informal conversations about what’s actually happening in math.” Taylor felt others viewed them as a leader, “…because I ask for help or I ask questions.” This willingness to be vulnerable and engage in dialogue about mathematics teaching and learning contribute to other staff member’s view of the liaison as a leader.

In addition to being open to talking about mathematics, the liaisons shared that other staff members may view them as leaders due to the fact they often go above and beyond the regular duties of teaching. Corey said,

> I think others in the building recognize I’m willing to go out on a limb and be vulnerable. I’m always willing to help others. People recognize I spend extra time

> doing anything and everything just because I feel like overall we need to be successful as a building.

Similarly, Avery shared about how they are not afraid to speak in opposition of something if it is not in the best interest of the students: “I’m willing to speak up and make change if something needs to be changed.” Vaughn added, “People trust me.”

Most liaisons seemed to recognize themselves as leaders or having leadership potential. Mindset and belief in one’s own capabilities appeared to be a factor that contributed to the liaison’s growth as teacher leaders. Liaisons discussed how having a positive mindset in their own abilities affected their own identity as a leader. Parker said,

> I feel like I’m more confident due to the fact I was asked to be a math liaison. That was a good message for me. I’m a lot more confident because I have these tools that I’m able to use.

Liaisons also recognized their growth as leaders due to participating in the liaison experience. “I’ve grown a lot and I’m not there yet. There is more I can do for myself, my team, and the whole school,” said Parker.

While liaisons felt being appointed as a liaison helped them recognize themselves as leaders, the liaisons felt they still needed encouragement. This motivation may have come from internal or external sources. Parker spoke of how a feeling from inside compelled them to be reminded of their own leadership: “I’m in this position for a reason and I need to recognize that. If I didn’t, I was being selfish with my learning.” Parker stated they often asked this question of themself, “What do I want to learn from this and what can I bring to the table in the area of leadership?” Conversely, other liaisons felt they needed encouragement from others to act as leaders. Vaughn stated, “I’m usually

approached by things and I feel pretty reserved. Again, it is where I need to be pushed to do things." Having someone else believe in their capabilities as a leader seemed to reinforce their beliefs about their own leadership. No matter where the encouragement came from, it appears that the liaisons needed someone to cheer them on to remind them of their own capabilities as a leader.

Summary of Findings

In response to the first research question, *What opportunities and contextual factors do K–2 teacher leaders identify as contributing to their growth as teacher leaders in mathematics?,* I found there were common opportunities and contextual factors that contributed to growth of the liaisons as primary teacher leaders. These findings indicate primary teacher leaders of mathematics commonly share that mathematics has not always come easy for them during their educational career. Often, the teacher leaders found math to be challenging or struggled. However, the teacher leaders did overcome these struggles, appreciate struggle as an important part of learning, and understanding what it is like to feel successful in mathematics. The teacher leaders shared a common characteristic in they felt supported by building administrators. The encouragement from the overall leaders in the buildings seemed to play a role in the liaison's leadership. The liaisons also view teacher leadership as valuable and identify as leaders. This positive mindset that leadership is important and that a person is capable of leadership impacts a teacher leader's work.

While this list provides insight into my research question, I understand that not all opportunities and contextual factors may have been identified through this study. A more extensive study may find additional opportunities and contextual factors that contribute to

a teacher leader's work in mathematics education at the primary grades. However, the findings do contribute to a greater understanding of what contributes to the growth of teacher leaders in mathematics education in primary grade levels.

Findings Related to RQ_2

In this section, I will examine my findings in relation to my second research question, *In what ways does a structured professional learning opportunity promote teacher leadership in K–2 teachers?* Four big ideas emerged in regards to how the liaison experience promoted teacher leadership in those who participated. These four themes are: (1) the lab day had a profound effect on the liaisons' learning, as the liaisons were able to engage in critical conversations regarding issues within mathematics education within a safe environment; (2) the professional reading resources were greatly valued as they added to the liaisons' understanding of effective teaching and learning for mathematics; (3) the self-directed nature of the professional learning experience provided a space for each liaison to become more knowledgeable in an area of their choice; (4) and the collaborative work built within the liaison experiences allowed the liaisons to learn and grow together. Next, I will unpack these themes to provide more insight into how these ideas surfaced as being instrumental to the liaisons' growth as teacher leaders in mathematics education.

Extended Learning Experience Contributes to Growth

Liaisons were given the option to attend a lab day as part of their liaison experience. The liaisons were released from classroom responsibilities to participate in a seven-hours-long, in-depth learning opportunity. Approximately 70% of the K–2 liaisons chose to participate in the lab day. The response from this experience was

overwhelmingly positive. The liaisons felt the day of learning was worthwhile as it provided a safe space for the liaisons to engage in more in-depth learning. The liaisons developed relationships with others and engaged in challenging conversations. Overall, the liaisons who took advantage of this opportunity felt as if the lab day was a beneficial learning experience.

One aspect of the lab day that the liaisons found to be useful was that they got to develop relationships with other liaisons from across the district. Avery shared,

> I thought it was so fun to meet some of the other teachers. It was nice to get to know people outside of your team. … The lab day was a really good experience as I stepped aside from working and got to spend time with other teachers in the district. … I built relationships with other people around the district.

Another liaison added, "I liked working with the other teachers from my grade level that day." Often, these relationships are not fostered due to the nature of the size of the district and the scope of a teacher's work, which mainly falls within the walls of the building in which the liaison works. Building relationships also meant developing trust among the liaisons. This trust was important, as it provided a safe space where the liaisons could be vulnerable. This environment and these relationships were important as then the liaisons could engage in honest and real conversations about mathematics education issues with one another.

The relationships the liaisons built because of the lab day were not limited to building relationships only among liaisons. In addition, the liaisons spoke of the relationships they built with district-level coaches. The liaisons appreciated the time spent with the district-level coaches as they could get to know them better. "I don't feel as

scared to reach out with a question. Now it is like, 'Hey, I need help,'" shared Avery. This was in response to how Avery's comfort-level changed. Avery felt they developed a sense of trust with the district-level coaches after spending an entire day of learning with them. The lab day provided time for liaisons and district-level coaches to become more acquainted and learn more about one another. It also contributed to a strengthened bond, with the liaisons becoming more comfortable interacting and working with district-level coaches. This relationship was important, as the liaisons felt more comfortable being able to participate in conversations, which centered on topics that had the potential to be sensitive for some.

Liaisons participated in several conversations about teaching and learning throughout the lab day. The topic of the conversations did not seem to play a role on the impact these discussions had on the liaisons as they seemed to find each one worthwhile. "A smaller group setting with educators being able to have those conversations was beneficial," shared one liaison. Another liaison stated, "It was nice to have the whole day with the same group of peers to discuss math and be vulnerable when talking about some harder topics." The liaisons appreciated the more intimate environment and longer time frame where they could engage in conversations about topics related to mathematics education with other liaisons. This safe environment allowed the liaisons to honestly reflect upon their own teaching and talk with others in regard to their strengths and challenges within the classroom.

During the first part of the day, the conversations centered on teaching and learning. The second part of the day focused on challenging issues facing mathematics

classrooms regarding equity. Liaisons mentioned how they appreciated having deeper conversations, specifically around the topic of equity. One liaison said,

> Discussing equity gave me another lens to look at as a teacher with my students. So that was a powerful thing. While someone came to our building and discussed cultural proficiency and equity, I needed this conversation to get to a little bit of a different level, which was nice.

Alex described these same conversations in this way: "Getting to have those deep hard conversations with really great teachers just was like that shot in the arm I needed." The liaisons appreciated having time to dive into more complex issues facing mathematics educators as a part of the lab experience. The structure of the lab day allowed for more intimate conversations due to the size of the group, which seemed to prompt deeper thinking about teaching mathematics.

The lab day resulted in a powerful day of learning for many who attended. Many liaisons shared their thoughts regarding their own personal growth they experienced from participating. Some liaisons outwardly expressed they were re-energized to teach mathematics. One liaison said, "Definitely the lab day was hands down the most powerful part of the whole liaison piece for me. I just saw a lot of personal growth that day." Another shared, "The lab day you offered was really amazing. I really left that day rejuvenated not just about math but about school in general." Similarly, someone else added, "It really renewed the teacher piece for me." Liaisons appreciated the fact they could put regular classroom duties aside for a day and focus on deepening their own learning related to effective mathematics teaching and learning by being vulnerable and honestly reflecting upon their own practices.

Professional Resources Contribute to Deepened Understanding of Pedagogy

Each liaison was given two professional resources, *Principles to Actions: Ensuring Mathematical Success for All* (NCTM, 2014) and *Taking Action: Implementing Effective Teaching Practices K–5* (Huinker & Bill, 2017). These texts were for the liaisons to keep. The professional learning during the liaison experience centered around these two professional resources. Response to these two texts was overwhelmingly positive, as the liaisons felt they provided information that broadened their knowledge about teaching mathematics. In addition, the liaisons shared the texts were relatable, and they could use the examples from the books to make connections to their classrooms. The liaisons also felt they could easily share information from the resources with their colleagues, which would broaden the knowledge of their colleagues as well. One liaison felt "the professional texts were good."

First, the liaisons felt as if the two texts provided them with knowledge in which they could grow as professionals. One liaison shared, "I've really grown a lot this year, especially through reading the textbooks. I'm not one to really enjoy textbooks but I just felt like they kind of hit home for things...". The liaisons felt as if they grew in their understanding of the eight effective teaching strategies for mathematics, as these were the focus of the readings. One liaison shared, "I felt a lot more confident in my understanding of mathematics after learning more about it." This confidence seemed to have stemmed from the liaison's deepened knowledge of instructional strategies which are specific to mathematics education. "I see there are methods and strategies to teaching mathematics and these ways have been tested and proven," said Corey, when speaking about the usefulness of the resources.

While the liaisons spoke of the usefulness of both professional resources, the second book, *Taking Action: Implementing Effective Teaching Practices K–5* (Huinker & Bill, 2017) seemed to strongly resonate with the liaisons. “I really appreciated the second book,” shared a liaison. One liaison specifically said, “It was a nice companion to the other one.” This comment was made in comparison to *Principles to Actions: Ensuring Mathematical Success for All* (NCTM, 2014), which provided a more general introduction to the eight effective teaching practices. The liaisons felt the vignettes and classroom examples in *Taking Action: Implementing Effective Teaching Practices K–5* (2017), were useful and easily relatable. “I think it was easy to relate what my students were doing and what they were doing in the book. There were parallel connections between the vignettes in the book and the everyday work of the liaisons. One liaison described these real-life examples in this way: “When there’s a case study, I could see my students in the students in the book. I feel like I got so many ideas for myself, too.” Another liaison shared, “I could see my students in the students. I got so many ideas and when my students were working on a task, I would find myself thinking back to the case studies and how the teacher responded.” The liaisons seemed to appreciate how *Taking Action: Implementing Effective Teaching Practices K–5* (2017) provided examples of real-life classrooms, some of which take place in primary classrooms. These examples, which could easily occur in the reality of a classroom, helped the liaisons see how the effective teaching practices were implemented with students.

The liaisons revealed that they felt the textbooks were worthwhile because they not only helped them deepen their knowledge regarding effective mathematics instruction but also in other content areas. A liaison spoke about the specific effective teaching

practice of questioning that they read about, “Mine went not only for math, but like every academic area. So like the purpose of questions, I started doing it more and then my students started asking more personal questions in reading. It kind of carried on to other academic areas, which was not intended.” Reading about an effective teaching practice for mathematics helped the liaisons see how the same practice might be applied to other content areas in which they teach. In addition, the more the liaisons dove into the effective practices, the more they wanted to continue to learn. “I want to continue to use the texts you provided,” shared one liaison as they spoke about continuing their learning beyond what was required for the liaison experience.

The liaisons described many instances where they shared information from the professional resources with colleagues in their respective buildings. Sometimes this sharing happened in small groups, such as team meetings, while other times it occurred in larger settings such as staff meetings. Vaughn shared how they incorporated information that was learned into her grade-level planning sessions: “So, I always share with them what we learn from the two books. I also took the questions from *Principles to Actions* and incorporated them into our collaborative planning sessions.” By doing so, this liaison helped their colleagues grow in their understanding of aspects of the effective teaching practices.

Other liaisons described how they shared information from the two texts on a larger scale. “I wanted to challenge the staff,” said Taylor as they discussed how they took excerpts from the two texts and sent them through emails to the other teachers in the building. Avery shared how they provided the staff in the building with a chart from *Taking Action: Implementing Effective Teaching Practices K–5* (Huinker & Bill, 2017).

"I gave the chart to my staff and challenged them to think about what types of questions they were asking. Or I gave them the option to plan five questions in advance of teaching a lesson as it is so important," Avery said. It appeared that the liaisons found the information from the professional resources beneficial, so they felt compelled to share it with those they worked. Parker said,

> I felt like I needed to go to my entire staff as a whole and say, look what I'm learning about. This is what I'm doing in my room and here are some things you could use or if you already use this you can celebrate those things.

Parker felt obligated to share the new knowledge they had gained as a result of being a liaison.

Overall, the liaisons seemed to greatly appreciate the texts, as they found them to be valuable resources that contributed to their heightened understanding of mathematics pedagogy. Comments such as, "I thought the texts you gave us were very, very helpful. They were important components to my learning experience," and "We got a lot of really amazing materials and were given opportunities for a lot of really great personal growth," seem to capture how valuable the liaisons found the professional learning resources to be. The two texts seemed to add to the liaison's knowledge of effective teaching of mathematics, while also strengthening their confidence in this area. One liaison captured this by saying, "I felt more empowered to talk about mathematics" from engaging with the ideas in the texts.

Self-directed Professional Learning Increases Learning

One theme that arose during this study that seemed to be influential in the growth of teacher leaders was that the liaisons appreciated how the learning experience was

structured. The learning was self-directed as each liaison was able to choose an effective teaching practice they wanted to learn more about. Once the liaisons determined the focus of their professional learning, it was up to them how they would proceed in terms of their own learning. The only requirement was for each liaison to read the chapter that corresponded to the teaching strategy they chose in *Taking Actions: Implementing Effective Teaching Practices K–5* (Huinker & Bill, 2017). Liaisons felt this structure for professional learning allowed them to have a choice on what they wanted to learn more about, provided them with time to reflect upon their own instructional practices, and the learning about effective teaching seemed to filter into areas other than mathematics.

The liaisons' statements about the self-directed structure of the learning experience were supportive of the newly implemented professional learning format. They felt tackling the entire book would have been too overwhelming and unrealistic given the timeframe of the liaison experience. However, the liaisons felt focusing on one effective teaching practice seemed to be manageable and worthwhile. Comments from liaisons included, "Setting the goal and then creating a plan of how I was going to achieve that goal was really helpful. I do like that I was able to focus on one thing versus a lot of things," and "It didn't overwhelm me at first. I knew I was just going to work on this one teaching practice." One liaison summarized their thoughts by saying,

> I liked that we focused on one area and I feel like that was more realistic for me with everything else going on in our lives. I do feel like I had a lot of strong growth in that one area and I'm so much more knowledgeable about that.

Liaisons appreciated being able to choose one which of the effective teaching practices they felt most compelled to focus on and learn more about. This element of choice and narrowing the focus for learning seemed to be popular among the liaisons.

The liaisons did not randomly choose the effective teaching practice on which they decided to focus. Rather, they participated in self-reflection to help guide them to a decision regarding what they would like to learn more about. “I really liked that you guys have us pick one of the teaching practices, as I did purposeful questioning,” shared a liaison. Narrowing the focus of the learning allowed the liaisons to dive deep into one aspect of teaching mathematics. “Learning about productive struggle in the text was most beneficial. It’s okay to really struggle and see that though struggle students are going to understand a lot more than just if they don’t have that,” shared Avery. A liaison shared similar thoughts regarding their learning about the effective teaching practice of fostering productive struggle: “I learned about productive struggle this year in the text and gained so much valuable information regarding this practice.” One liaison said, “I didn’t really feel like I fully understood what it [productive struggle] meant. I wasn’t even aware that I was already using it at times. I feel like I’m a lot more confident now because I have all of these tools that I can use to build upon what I’m already doing.” Each liaison felt they became more knowledgeable about the teaching practice they chose to learn more about.

While the liaisons appreciated being able to focus on one effective mathematics teaching strategy, they saw growth in other areas of their teaching as well. “It didn’t overwhelm me at first as I knew I was just going to work on one thing. But in the end, I really had improvement on all of the practices because they’re so integrated with each other,” shared one liaison as they spoke about how their learning branched out beyond

the one effective teaching practice that they chose to focus on. Another liaison shared their similar experience, “I was just going to work on this one practice but in the end, I saw improvements in other things because they are so integrated with each other.” Often, liaisons started to see how the effective teaching strategies such as productive struggle and purposeful questioning are not isolated to mathematics but apply to other content areas as well. Vaughn shared, “I did purposeful questioning and it just dawned on me that through just focusing on questioning, I really hit a lot of the other ones as well.” It took time for the liaisons to realize the interplay of these strategies within different content areas taught across an elementary school day.

The self-directed structure of the liaisons not only allowed the liaisons to choose what they wanted to focus on but also allowed time for them to reflect upon their own practices. While this time for reflection was built into the new liaison structure, the frequency in which the liaisons chose to engage in self-thought beyond the few times built into the liaison meetings was up to each individual liaison. “I had a chance to really reflect on my own teaching,” stated a liaison as they described what they found to be the most beneficial aspects of the liaison experience. The liaisons seemed to appreciate time to think about their own context and their own learning. One liaison admitted, “I just wasn’t giving the time to questioning that I should have been.” Another shared a personal reflection, “I just dove into productive struggle and made sure I wasn’t helping them right away. It really helped with their confidence.” This time for reflection provided space for the liaisons to think about their own teaching and honestly assess where they stood upon a continuum toward excellence within the effective teaching practice they chose.

The liaisons did not see their learning come to an end as the liaison experience concluded. Rather, they expressed how they thought their learning journey would continue. “I had a lot of growth in that area and now I’m thinking since I tackled this practice this year, I’m going to continue to do this,” said one liaison as they shared their desire to keep learning professionally. Another shared, “I will continue to improve as I get used to asking different types of questions.” These specific comments show that even though the liaisons would not continue to be liaisons for their respective buildings, they would sustain their own learning into the future.

Overall, the liaisons appreciated the new structure of the liaison experience and how it felt more like a professional learning opportunity rather than its meeting-like feel in the past. Vaughn shared,

> I just really appreciated how this was more of a staff development than like, “Here’s the information and please share it with your school.” I just feel like it was a better use of our time and I enjoyed the resources that I was given and the chance to really reflect on my own teaching to do well.

The self-directed nature of the liaison’s professional learning seemed to be successful and contribute to their growth as a teacher leader. One quote from a liaison summarizes this, “It’s more about growing yourself professionally and you know, growing in a leadership position.”

Opportunities to Strengthen Professional Networks

Liaisons expressed that they found the collaborative nature of the professional learning experience to be beneficial and contributed to their growth as teacher leaders. The time they spent discussing aspects of teaching and learning with other primary

educators, and engaging in learning together, was one aspect of the liaison experience the liaisons felt to be most worthwhile. The liaisons appreciated time to work with one another, as this helped to develop stronger relationships between the liaisons. In addition, the liaisons sensed they created connections beyond that with one another; they felt as though they strengthened their relationships with district-level coaches as well.

Liaisons appreciated time to talk with other teachers from outside of the building in which they worked. “I really had a good experience working with other teachers from the district, which we don’t always get the opportunity,” said a liaison as they described the collaborative nature of the professional learning experience. The nature of liaison meetings provided time and space for these teachers to come together and discuss issues related to teaching mathematics.

These discussions were found to be useful as the liaisons could talk about issues related to teaching mathematics and learn they were more widespread than they may have originally believed them to be. Taylor shared these insights: “I saw this was a universal problem, not just my building’s problem.” This benefit of discussing issues with others was widespread. “Anytime we can get people together to talk about what we do and have conversations about the reality of what’s happening helps me understand I’m not the only one experiencing these things in relation to teaching mathematics,” stated another liaison. Providing time for the liaisons to talk about general issues regarding teaching and learning of mathematics seemed to be worthwhile.

While the liaisons appreciated time spent in having discussions in random groupings, they seem to particularly value the time they spent in grade-level groups:

> I really enjoyed being able to have conversations centered around math with other teachers at my grade level as well as other grade levels. I was really able to have deep conversations with others and then bring some aspects of those deep conversations back to my own building.

Another liaison spoke in support of these conversations,

> One thing I especially liked was when I got to talk to someone who teaches the same level. It was nice when I got paired with another first-grade teacher. It was so nice when you share those experiences with someone who was going through the exact same thing that you are.

These inter-grade level discussions may take place within buildings; however, some buildings may hold them more frequently than others. The conversations allowed the liaisons to talk about issues that were directly related to the grade-level content they teach and corresponding topics. Parker shared this about these conversations, “It validated things I was already doing that were working. And I felt as if I could then tweak or enhance the things that I needed to focus on.” Having time to discuss topics and collaborate within grade-level specific groups seemed to be appreciated by the liaisons.

The liaisons were able to engage with each other during the lab day in addition to the four regular meetings. This opportunity allowed them to get to know the other liaisons in attendance on a deeper level, and new professional relationships formed. Parker shared this about the lab day experience: “The lab day was a really good experience as I stepped aside from working and got to spend time with other teachers in the district. I built relationships with other people around the district.” The lab day provided an avenue for the liaisons to work and learn together. They found that the nature

of the lab experience contributed to the success of the day. “I felt it was a really good working relationship the day of the lab,” said a liaison as they summarized their thoughts regarding the lab.

The liaisons found value in having time to collaborate with others as they grew professionally because of the liaison experience. This development of professional relationships between liaisons was not the only partnerships being developed; liaisons recognized that they developed relationships with district-level leaders as well. “I really liked the classroom experience,” said one liaison as they described how the district-level leader concentrated on individual goals with each liaison. One liaison said, “Having you come out to my classroom and observe me and then coming back out and reflected on the lesson with me were good opportunities.” It did not seem to matter what the focus of the work was, as the liaisons saw benefit in the time they spent working jointly with a district-level coach.

The development of support networks during the liaison experience took on many forms. Sometimes liaisons had conversations with teachers from different grade levels. Other times this happened in groups of teachers who taught the same grade level who engaged in thinking about problems related to their work. Opportunities for collaboration took place during the four liaison meetings, during the lab day, and in conversations between individual liaisons and a district-level coach. Whatever the format, the liaisons seemed to find value in these different occasions as they seemed to contribute to their development as teacher leaders.

Summary of Findings

In pursuit of finding answers to my second research question, *In what ways does a structured professional learning opportunity promote teacher leadership in K–2 teachers?* I found there were certain aspects of the liaison experience that contributed to teacher leadership in K–2 teachers. These findings indicate that primary teachers of mathematics found value in having time to engage in professional learning. The extended learning opportunity, or optional lab day, that was offered to liaisons appeared to be the highlight of the experience for those who participated. The lab day provided more time and a safe space to explore pivotal topics related to mathematics education. Liaisons also appreciated the professional resources that were given to them. These two professional books contributed to the liaisons' understanding about mathematics pedagogy. The more the liaisons learned, the more they tended to reflect upon and refine their current practices. The content of this learning was not dictated by the leaders of the liaison group, rather each liaison was able to choose which effective teaching practice for mathematics they wanted to learn more about. This self-directed nature of the professional learning created buy-in and allowed each liaison to choose a topic they were invested in. Thus, the learning was increased. Finally, the liaison experience provided opportunities for the liaisons to engage with other liaisons. These partnerships were worthwhile as liaisons could support one another and learn from one another throughout the process.

These four themes provide insight into how a structured learning opportunity promotes teacher leadership in K–2 teachers. I recognize the themes that I have identified are not an exhaustive list. A more detailed investigation may uncover other ways in which a structured learning promotes teacher leadership in teachers of the primary

grades. However, as a result of this study my findings provide more insight to my understanding of what aspects of a structured professional learning experience, such as the district's liaison group, contribute to the growth of kindergarten, first, and second grade teachers as teacher leaders in mathematics.

Summary

In Chapter 5, I discussed the findings from my study. These findings provided me with a richer understanding into the development of teacher leaders because of participating as a math liaison during the 2018–2019 school year in relation to my two research questions:

RQ_1: What opportunities and contextual factors do K–2 teacher leaders identify as contributing to their growth as teacher leaders in mathematics?

RQ_2: In what ways does a structured professional learning opportunity promote teacher leadership in K–2 teachers?

In this chapter, I shared insights into the data collected from each of the six liaisons who were a part of the focus group. I discussed themes that emerged from their personal accounts. Following my initial discussion, I highlighted similarities and differences found within the six liaisons as they developed as teacher leaders.

Next, I discussed the results from the survey that liaisons completed at the beginning and end of their experience. These results represent a broader population than those liaisons who were a part of the focus group; however, the data shows trends in how the liaisons perception of their own leadership evolved over the course of the 2018–2019 school year. I shared insights into the themes used during the coding process, and discussed how the themes related to my two research questions. My findings indicate the

following opportunities and contextual factors that K–2 teacher leaders identify as contributing to their growth as teacher leaders in mathematics are:

- Personal experience with navigating productive struggle in mathematics
- Supportive building administrators
- Positive views of leadership
- Characterizes self as a leader

In response to my second research question, my findings regarding the ways a structured professional learning opportunity promotes teacher leadership in K–2 teachers are:

- Extended learning experience contributes to growth
- Professional resources contribute to deepened understanding of pedagogy
- Self-directed professional learning increases learning
- Opportunities to strengthen professional networks

At the end of this chapter, I drew conclusions about the overall findings in relation to teacher leadership in relation to my two research questions. I highlighted my new learning as a result of this study and how these findings contributed to a deeper understanding of the development of teacher leadership within K–2 mathematics teachers. In the next chapter, I will discuss the conclusions and share implications for my scholarly investigation.

CHAPTER SIX: CONCLUSIONS AND IMPLICATIONS

The purpose of this research study was to gain a deeper understanding of the common characteristics of teachers as they developed skills as a teacher leader as a result of being involved in a specialized professional learning opportunity offered by a large, urban school district. It was my goal to gain insights into the two research questions:

RQ_1: What opportunities and contextual factors do K–2 teacher leaders identify as contributing to their growth as teacher leaders in mathematics?

RQ_2: In what ways does a structured professional learning opportunity promote teacher leadership in K–2 teachers?

In this chapter, I will first connect my study to the PrimeD Framework (Rakes et al., 2017; Saderholm et al., 2017). The PrimeD Framework provides a structure for monitoring, evaluating, and adapting professional development efforts. This framework offered guidance throughout my study as I designed, implemented, and refined the professional development experience for liaisons. In addition, the framework offers guidance as I develop professional development experiences for future liaison groups.

Next, I will connect my findings to related scholarly literature and address ideas that were similarly found. This connection will contribute to my understanding of teacher leadership, as the similarities between the literature and my findings will help me gain a deeper understanding of the knowledge I gained in regard to teacher leadership development at the primary level. The distinct differences that emerged will be discussed as well. These findings from my study that do not necessarily run parallel with the work of others will provide me with ideas related to leadership to consider researching in the future.

After connecting my findings to scholarly literature, I will address the limitations and implications of this study. It will be important for me to list the constraints that prohibit the findings of this study to be generalized to other contexts. The outcomes of this study are unique to the situation and to those involved. However, the findings will inform future liaison experiences within the district in which I work, as well as provide suggestions for other districts which may choose to replicate aspects of the liaison experience in their own educational environments.

Following the discussion of limitations and implications, I will share updated information for the six liaisons who were the focus of this study. This information on the liaison's current leadership will provide insight into the next steps of their respective leadership journeys. Next, I will share what I learned as a leader and the changes I will make to the liaison experience moving forward as a result of this in-depth study. As a conclusion to the chapter, I will offer ideas for related research in the future.

A Framework for Design, Implementation, and Evaluation

The PrimeD Framework (Rakes et al., 2017; Saderholm et al., 2017) was used throughout the duration of this study as it provided guidance on the design and development, implementation, and evaluation phases of this scholarly investigation. The framework is based on elements of effective professional development, those components that have an impact on classroom practice. In Phase I of the framework, there is a central focus and problem to be solved in professional development. My study had a common vision and design, as it was based on improving mathematics instruction at the primary level. The focus of this study was to gather greater insights in regard to the development of teacher leadership in K–2 mathematics teachers, as teacher leaders hold the potential to

influence the practice of others. This professional learning experience targeted primary teachers who were serving as math liaisons, to influence their knowledge and practice. The targeted professional development experience, set in the context of Math Liaisons, was conducted with the desire to further develop the liaisons' knowledge of effective strategies for teaching mathematics and assist them in exploring leadership opportunities within K–2 mathematics.

The framework provided guidance in the implementation of the plan once district leaders generated a vision for how to develop teacher leadership in K–2 teachers and planned the liaison experience. The learning community of liaisons came together to look more deeply at effective mathematics instruction, engaged in conversations regarding current classroom practice, and engaged in collective problem solving. The liaisons also collaborated to develop professional networks and leadership. In addition to these tasks, the liaisons transferred their newly acquired knowledge of mathematics pedagogy to their own classrooms. The liaisons tried new strategies and instructional approaches, problem-solved, and were willing to share their success and challenges with their peers.

Phase III of the PrimeD Framework focuses on evaluation of a program, both formatively and summatively (Rakes et al., 2017; Saderholm et al., 2017). The process of evaluation was ongoing throughout the liaison experience. I collected evidence of success and challenges through observations and informal conversations with liaisons. In addition, I gathered data at the conclusion of the liaison experience. This was done through a large-group conversation at the last liaison meeting of the year. Then, I analyzed the transcripts from this conversation, as well as the interviews of the liaisons who participated as part of the focus group. Collectively, these data provided insight

about the program's outcomes and offered support for current and any potential future research of the program.

The goal of this professional development experience was to equip K–2 mathematics teachers with knowledge of effective instructional practices and help them become more aware of opportunities for mathematics leadership in their respective contexts. The use of the PrimeD Framework to structure the professional development experience assisted me in reaching this goal. The framework provided me with a structure to reflect upon the numerous components of the math liaison experience and determine both the successes and weaknesses of this professional learning experience.

Connecting Findings to Literature Review

This study was based on the theory that teachers who serve as teacher leaders are uniquely positioned to promote change within the school context. This is because teacher leaders are knowledgeable about the work that takes place in classrooms as well as the complexities of teaching (Mangin & Stoelinga, 2008). Teacher leaders have the potential to increase effective mathematics instruction as they work with others to deepen understanding of effective pedagogical practices. In examination of the literature in Chapter 2, gaps identified in the research indicate there is a need to know more about teacher leaders, especially in the context of mathematics education. Also, there was little research about teacher leadership at the primary level. York-Barr and Duke (1994) and Wenner and Campbell (2017) specifically called for studies to be dedicated to learning more about the ways in which teachers transform into the role of teacher leaders and how professional learning can play a pivotal role in this work. Therefore, this scholarly investigation attempted to gain more understanding of the intersection of teacher

leadership in mathematics education and teacher leadership at the primary level and in what ways a professional learning opportunity could contribute to their development.

Opportunities and Contextual Factors

One finding identified in Chapter 5 was that most of the liaisons shared the same type of experiences as a learner of mathematics. A large percentage of the liaisons shared personal accounts of how they struggled in mathematics sometime during their educational career. The liaisons felt experiencing and overcoming struggle at some point as learners influenced their teaching. Understanding firsthand how it feels to struggle, as well as how it feels to be successful by navigating productive struggle, influences the liaisons' actions as both teachers and leaders. This finding supports Huggins, Lessig, and Rhodes' (2017) belief that a teacher must understand themselves both as teachers and as learners. Having experiences to draw upon, the liaisons could use their personal experiences of learning mathematics as a reason for implementing the effective teaching strategies into their own classroom. In addition, the liaisons could build upon their work in their own classrooms to assist others with similar practices.

In Chapter 5, one finding was that the K–2 liaisons had administrators who were supportive of their work. These teacher leaders spoke highly of the principal and/or assistant principal in their respective buildings. This was concurrent to the findings of York-Barr and Duke (2004), who found building administrators play an important role in fostering leadership in teacher leaders. Liaisons were given opportunities for leadership by their building administrators, both within and beyond the classroom. A key aspect of this relationship between teacher leader and building administrator is that there is a high

level of trust. This trust allows the teacher leader to take risks, try new things, and take on leadership roles of which they may not believe they are capable.

Personal and environmental factors contribute to the success of a teacher leader. In addition to the liaison's personal experiences as a learner of mathematics and positive relationship with administrators, the liaison's broad view of leadership seemed to play an influential role in their development as teacher leaders of mathematics. My findings suggest when the liaisons view leadership as an avenue for making change, this view contributes to their development as teacher leaders. The liaisons embraced the idea that leadership can make a difference, and engaged in work for greater achievement outcomes. This finding runs parallel to the work of Childs-Bowen, Moller, and Scrivner (2000) who suggest that teachers are leaders when they engage in work of professional learning communities to impact student learning; inspire others to improve instructional practices; and invite and empower others to join them in making educational improvements. The teacher leaders in this study embraced and exemplified these characteristics, as their work reflected the idea that leadership can make a difference.

The liaisons view leadership as worthwhile and as a vehicle to make instructional improvements. While the liaisons took this stance in relation to leadership, they did not overtly say, "I am a leader." This runs parallel to Fairman and Mackenzie's (2012) work, which uncovered teachers were reluctant being regarded as "leaders," as they were unwilling to take on formal titles that might blur that work informally to effect instructional change. While the liaisons did not self-identify as leaders, they did describe how they felt their peers perceived them as leaders. Gee (2003) states this as a piece of identity, the way in which an individual is perceived by others. Identity also is formed by

the way in which an individual perceives themself. It is likely the liaisons are wallowing in this sense-making of self-identifying as leaders, as they are seeing how others perceive their leadership. This creates a nexus of multi-memberships that the liaisons are trying to identify with, which Wenger (1998) believes is where individuals make sense of various roles. The K–2 liaisons were not only making sense of who they were as learners and teachers of mathematics, but leaders of mathematics. In alignment with the collaborative study of Ross et al. (2011), it was found that teachers' transformed perspectives helped them to define themselves as leaders. My findings suggest the more their colleagues recognized them as leaders of mathematics, the more the liaisons began to think of themselves in that way as well.

Fostering Teacher Leader Growth through a Structured Professional Learning Experience

The goal for this study was to learn more about K–2 teachers' teacher leadership development in mathematics. One major insight into this work was how critical it was for the teacher leaders to build relationships with other professionals who were engaged in the same type of work. The liaisons shared many personal accounts about how they felt they developed bonds with other liaisons, as well as district-level leaders, because of participating in the professional learning experience. This idea of the important role a community has on a teacher leader was echoed in other studies (Caine & Caine, 2000; Wenner, 2017). These relationships the liaisons built helped them become more aware of the interconnections between each other, as well as built a sense of empowerment and efficacy.

Professional networks play an important role in teacher leaders' development. These networks allow the liaisons to become acquainted with what liaisons in other schools were doing, create a common language, build connections, and foster the development and sharing of new ideas and improvement in practice (Hatch et al., 2005). The liaisons identified several opportunities within the professional learning experience that facilitated building relationships. These include conversations within the large group meetings, the lab day, and the personalized work with a district-level coach. These opportunities impacted the liaisons' development as teacher leaders, as they provided time and space for the liaisons to talk about effective mathematics teaching and learning.

Scholarly literature suggests when a program invests in teacher leaders by focusing on mathematics content and pedagogy, positive changes are found in relation to the overall buildings in which the teacher leaders worked (Hopkins et al., 2013). Two themes identified in my study relate to the liaisons' professional growth in respect to mathematics education. These findings provide insight into how the liaison's understanding of mathematics pedagogy developed because of critical conversations and engaging with professional texts. The liaisons contributed their growth to their increased understanding of effective teaching in mathematics through these learning avenues.

Knowing these learning opportunities contributed to the liaison's growth as teacher leaders is a valuable finding, as teachers' situated knowledge of mathematics content and pedagogy make them the most likely candidates to lead instructional improvement efforts within their schools (Harris & Muijs, 2005; Mangin & Stoelinga, 2008). These aspects of the professional learning experience were identified to be very beneficial to the liaisons' deepened understanding of mathematics teaching. Therefore,

these outcomes of the professional learning experience have the potential to influence the liaison's work as K–2 teacher leaders in their respective buildings.

Lastly, the liaisons identified that they were much appreciative of the structure of the professional development experience. Most of the learning was self-directed, in that each liaison could choose the path for their own learning within the context of effective instruction for mathematics. The liaisons found benefit in navigating their own learning, which was driven by self-assessment and reflection. Similar results were found in other programs that had the same goal to foster teacher leadership (Hunzicker, 2012; Ross et al., 2011; Taylor et al., 2011), as results were most impactful when the liaisons were able to guide their own learning. Similar to other studies, this study found the liaisons appreciated the fact the learning was self-directed and job-embedded. The liaisons found value in a professional development program that was predetermined.

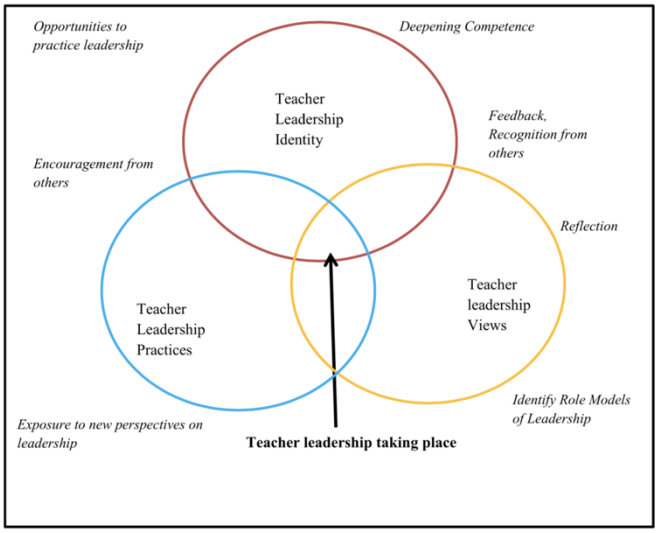
Leadership Development Process

Teacher leader development is not linear. Rather, it is the complex interplay where many aspects of teacher leadership reside. Sinha and Hanuscin (2017) provide a visual model of the teacher leadership development process, which is shown in Figure 14. At the intersection of teacher leader practices, teacher leader identity, and teacher leader views is where teacher leadership is taking place. These facets of teacher leadership are housed within several contexts that support the growth of this leadership. These facets include: opportunities to practice leadership, encouragement from others, feedback, exposures to new perspectives on leadership, deepening competence, and reflection. The findings of my study are supported by Sinha and Hanuscin's work, as the liaisons revealed they valued the time spent collaborating with other liaisons, as they found it

beneficial to reflect upon effective teaching practices and support each other as they engaged in the work. The liaisons also felt they added to their knowledge about teaching and learning mathematics. Finally, the liaisons shared they appreciated the opportunities to demonstrate their leadership within mathematics. The liaisons' identities developed as they started to believe more about their abilities to be a leader within mathematics, they viewed teacher leadership as worthwhile and needed, and they had opportunities to practice leadership. Therefore, at the heart of these three ideas, identity, practices, and views, is where teacher leadership happens. Concurrent to this model, I believe that the K–2 liaisons were developing as teacher leaders because of their liaison experience.

Figure 14

Leadership Development Process (Sinha & Hanuscin, 2017)



Summary

The findings of my study are supported by previous research. The unique aspect of my particular study is that I specifically looked at teacher leader development of K–2

teachers in the context of mathematics. These two areas, teacher leadership at the primary level and teacher leadership in mathematics, were gaps in research as identified in Chapter 2. This study contributes to our knowledge of teacher leadership in mathematics education at the primary level, as it provides insights into an area that has not been largely investigated.

Limitations

As with any research, there are limitations due to the nature of the study. Here, I will address the confines of the study that I conducted and how the limitations may impact being able to generalize the results of this study to broader contexts. These limitations include conducting the study in one district, only having six participants in the focus group, and collecting data over the course of one year. In addition, I was simultaneously conducting research and was an active participant in leading liaison meetings and activities. This may have caused potential conflict between the enactment of the study and data collection.

One of the most apparent limitations of my research was that the study was conducted in one school district. This site was chosen due to the fact it was the district in which I worked. While this study did provide insights into the development of K–2 teacher leaders in mathematics with the context of one school district in the Midwest, the findings do not necessarily apply to the similar work of others in different settings. The conditions of this study were unique to the school district in which the research took place. Others who are considering implementing a similar professional development opportunity to foster teacher leaders of mathematics at the primary level should be mindful of their own contexts and unique circumstances.

While 17 liaisons provided consent to participate in the study, only six liaisons participated as part of the focus group. The six participants shared their personal stories and provided insights into the development of teacher leadership in the primary grades. The information these liaisons offered about teacher leadership was informative and useful in drawing conclusions; however, the number of liaisons who participated in the focus group was relatively small. Having more participants involved in the focus group would have provided richer insights into the development of teacher leadership. While a greater number of participants in the focus group would have been ideal, increasing the number of interviews that needed to be conducted may have greatly extended the time needed to conduct all of the aspects of this study.

The six participants that were asked to be a part of the focus group were chosen for intentional reasons, which was done to find balance within a number of categories. While the goal was to get a broad representation among the participants in several different categories such as years of experience and past leadership, this was not doable in certain categories. The focus group was heavily skewed toward females, with only one of six participants being male. Although only one male was chosen to participate in the focus group, the percentage of males to females in the study seemed to mimic the ratio within the demographics of K–2 teachers and liaisons. The fact that not everyone in the focus group attended the lab day is a limitation of this study. While it would have desired to have all six of the liaisons of the focus group participate in the lab day, certain reasons prohibited this from being the case.

This research study took place over the course of one school year, specifically seven months, due to the fact the liaison experience began in September 2018 and

concluded in April 2019. Studying the liaisons over the course of a school year provided benefits in that the development of the teacher leaders could take place over a period of time. While the extended time was useful in seeing the progression of leadership development, just one group of liaisons were involved due to the nature of the experience over the course of a school year. Expanding the research study to more than one year and more than one group may have provided greater insights and/or different findings due to more time being allocated to developing leadership.

This study took place during the initial year of restructuring the liaison experience. Prior to this year, it was the responsibility of each liaison to attend each liaison meeting to gather messages and information from the district's math department. Following each meeting, each liaison was charged with relaying the information back to the other teachers in their respective building. This historical format of liaisons was no longer needed; thus, a change was made in an attempt to make the liaison experience more worthwhile. Because this was the first year this systematic structure was made, it may have provided conditions that were unique to the implementation of the new structure of math liaisons.

I served as both the researcher and facilitator of the liaison experience. My dual involvement may have created circumstances where conflicts could have emerged between my role within the district as the K–2 Mathematics Coordinator and my role as the researcher. I did not serve in an evaluator role, however my position at the district level may have made it difficult for some liaisons to speak honestly. While I do not believe any substantial conflicts arose from serving in both capacities, my living in both worlds did have the potential to cloud my view or interpretation of the findings.

Conversely, serving in both positions as the researcher and the facilitator may have provided me with opportunities to see the development of leadership firsthand that I may not have been aware of if I had acted solely as a researcher.

It is important to address the number of limitations that may have affected the outcome of this study. Limited locations, participants, and time all had the potential to play an impact on the findings of the study. In addition, the fact the liaison structure was in its first year of implementation and because I served as both the facilitator of the group and researcher, findings may have been impacted. However, limitations are inevitable as every research study has at least one special condition that has the potential to influence the outcomes.

Implications

At the conclusion of a study, it is appropriate for the researcher to answer the question, "Why does this study matter?" As I reflect upon all that I am taking away as a result of this investigation, there are a number of conclusions I have drawn regarding the liaison experience and teacher leadership. I have gained more insights into my research questions:

RQ_1: What opportunities and contextual factors do K–2 teacher leaders identify as contributing to their growth as teacher leaders in mathematics?

RQ_2: In what ways does a structured professional learning opportunity promote teacher leadership in K–2 teachers?

Implications for Opportunities and Contextual Factors Influencing K–2 Teacher Leadership

Here, I will discuss the findings and related implications in regard to my first research question, *What opportunities and contextual factors do K–2 teacher leaders identify as contributing to their growth as teacher leaders in mathematics?* I will address implications and how these may impact teacher leader leadership development in future professional development programs. Facilitators of future programs are encouraged to consider these ideas as they craft their own professional development programs to promote teacher leadership within K–2 mathematics teachers. These themes include navigating productive struggle as a learner, inviting building administrators to participate with the teachers during professional development, and allowing sufficient time for the teacher leaders to recognize their own leadership abilities.

Navigating Productive Struggle

Five of the six liaisons interviewed spoke of their personal experiences with struggle as a learner of mathematics. While the liaisons experienced trying times as a learner of mathematics, they endured hardships of learning, overcame these difficulties, and felt what it means to be successful in mathematics. Through their experiences, they learned the power of struggle. These personal accounts of successfully navigating struggle seemed to influence the liaisons' approach to teaching mathematics, as well as leading in mathematics. These experiences seemed to provide a "why" for the teacher leaders. The teacher leaders could better relate with their students and had a clear picture of what mathematics teaching and learning is to include.

Some liaisons did not share these same trying times in mathematics. Rather, their learning journeys were overwhelmingly positive. However, these liaisons who did not encounter struggle as students seemed to have other learning opportunities where they experienced struggles as learners. During the second liaison meeting, the liaisons were given a problem-solving task. This problem was not necessarily easy to solve; however, the liaisons persevered and came to an understanding of the solution at the end of the experience. Parker, the one liaison who did not experience the hardships as a learner of mathematics, did find the problem to be challenging and employed different strategies when they began to struggle while working to find the solution to the problem. Parker shared they took this problem to their staff and had them solve it as a part of a staff meeting. The fact Parker wanted to replicate this experience for their staff seemed to indicate they found value in working through the challenging task as it was useful to examine mathematics teaching and learning through a lens that incorporated struggle.

Because the liaisons either directly spoke about how they navigated struggle at some point in their educational careers as a learner of mathematics, or found benefit in a task which promoted productive struggle, leads one to believe that personally overcoming struggle might play a significant role in being a teacher leader of mathematics at the primary level. Therefore, it may be important for facilitators of professional learning experiences for teacher leaders to create opportunities for the participants to experience struggle. Even if the participants have had personal accounts where math did not always come easy for them, reliving such experiences as teachers might allow them to gain a deeper appreciation and perspective of how experiences with struggle help shape learners of mathematics.

Incorporating tasks for teacher leaders to work through, such as the bellman problem used during the second liaison meeting, might help teacher leaders reflect upon what it feels to be a learner of mathematics when a solution does not come right away. The teacher leaders can then reflect upon this experience as they work to best meet the needs of their students. The content that teachers deliver in kindergarten, first grade, and second grade is not challenging for most adults. Because the content is easily understood by the teachers, it may be more difficult to relate to students who do not understand the content right away. Therefore, experiences that put the teacher leaders "in the shoes of the learners" during teacher leader development programs may be worthwhile.

Inviting Administrators to Engage with Teachers during Professional Development

The liaisons who had support from their building leaders seemed to take more risks as teacher leaders, thus they experienced more growth than those who did not. The encouragement these liaisons received from their administrators appeared to contribute to their confidence as leaders, which led the teacher leaders to extend themselves beyond their own classroom or grade-level team. Several liaisons chose to address their entire staff within the context of mathematics teaching and learning, which was a new experience for these liaisons.

Because having supportive administrators appeared to play an influential role in the growth of K–2 teacher leaders in mathematics, it may be important that future professional learning experiences for teacher leaders incorporate some type of learning for the administrators. By inviting the administrators to participate with the liaisons in some way during the professional learning experience, several things may be accomplished. First, it may strengthen the bond between the teacher leader and building

administrators. From the interviews, the liaisons felt this was an important ingredient to their growth as teacher leaders in mathematics. Second, having administrators participate in some way may invite the building administrators to reflect more about the mathematics teaching and learning happening in their buildings. This, in turn, may provide additional opportunities for the teacher leader to demonstrate their leadership within the building.

What might it look like to involve building administrators in a structured professional learning opportunity that promotes teacher leadership in mathematics? Building leadership might be invited to participate in a mathematics task and or follow-up conversation. It might appear as a joint conversation with building administrators and liaisons about capitalizing on the teacher leaders' knowledge of effective teaching practices for mathematics. Or, it may be that the liaisons are given a specific "assignment," in which they are asked to meet with their building administrators and make a plan for how to capitalize on the liaison's knowledge of mathematics teaching and learning to make system-wide improvements in their respective buildings. Whatever the case, inviting the administrators to become more involved in the liaison's growth as a teacher leader of mathematics may be beneficial.

Allowing Sufficient Time for Teacher Leaders to Recognize their Leadership

While the liaisons viewed teacher leadership as being impactful, most were hesitant to overtly recognize themselves as leaders of mathematics. Most described themselves with characteristics of leadership and seemed to indicate their leadership grew on the post-survey, however no liaison came out and declared, "I am a leader of mathematics." Why might this be the case? It may be the liaisons were reluctant to take on formal titles such as Fairman and Mackenzie's (2012) research suggests. Or, it may be

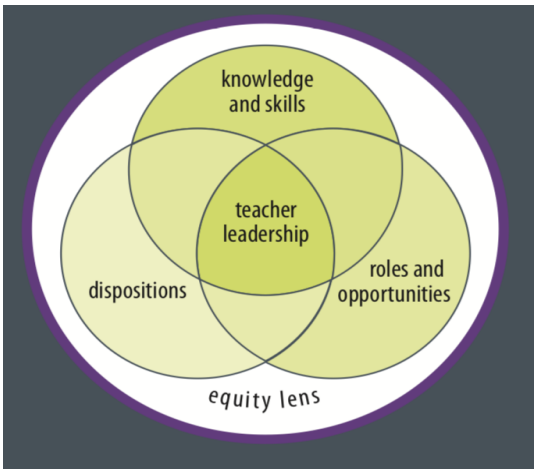
that the liaisons were trying to make sense of their various roles (Wenger, 1998). It is likely that these two ideas emerged in the case for the 2018–2019 liaisons. Perhaps the K–2 liaisons were still making sense of who they were as teacher leaders in mathematics, and more time was needed for them to shape their identities as leaders. For future professional development programs that promote teacher leadership at the K–2 level, more time may be needed. The liaison experience spanned across six months, which did not seem to be enough time for the liaisons to fully develop their identity as leaders. Paulus and Drath's (1995) work would support this idea, as they argue leadership development is best when spans years rather than months. Time is needed for teachers to transform their ideas about mathematics and leadership. As Ross et al. (2011) suggests, teachers' transformed perspectives helped define themselves as leaders. Perhaps with more time, such as spanning the liaison experience over two school years, the K–2 liaisons may be able to more confidently self-identify as leaders of mathematics.

Implications for Promoting K–2 Teacher Leadership

What insights does this study provide in regard to the second research question, *In what ways does a structured professional learning opportunity promote teacher leadership in K–2 teachers?* Overall, the 2018–2019 liaison experience contributed to the liaisons' dispositions as leaders, deepened knowledge and skills in mathematics, and provided the liaisons with roles and opportunities to display leadership. The teacher leadership skills framework created by The Center for Strengthening Teacher Performance's (2018) provides a visual representation of how these three areas, disposition, knowledge and skills, and roles and opportunities merge together within the context of equity, to define teacher leadership (see Figure 15).

Figure 15

Teacher Leadership Skills Framework (The Center for Strengthening Teacher Performance, 2018)



The math liaison experience during the 2018–2019 contributed to the development of K–2 liaisons as teacher leaders. The teacher leadership skills framework provides a general sense of how the goals of the different components of the liaison program merged to promote teacher leadership. The liaisons' knowledge and skills related to mathematics teaching and learning were deepened due to their study of the effective mathematics teaching practices. Liaisons felt the time they had to study current resources in mathematics pedagogy impacted their own leadership development. The liaisons appreciated getting the resources, such as *Principles to Actions: Ensuring Mathematical Success for All* (NCTM, 2014) and *Taking Action: Implementing Effective Mathematics Teaching Practices in K–Grade 5* (Huinker & Bill, 2017). These resources that were specific to mathematics pedagogy were not resources most of the liaisons were familiar with prior to the liaison experience. The time they had to become familiar with

all the effective teaching practices and intensely study one teaching practice of their choice contributed to the liaisons' knowledge of mathematics teaching.

Liaisons found the extended learning opportunities, specifically the lab day, to be beneficial. Not only did the liaisons feel that participating in this additional professional learning added to their knowledge of mathematical content and pedagogy, but also they felt it provided them with an opportunity to collaborate with other teacher leaders. As a result, professional relationships were fostered and strengthened. Experiences that allow teacher leaders to dive deeper into ideas related to mathematics teaching and learning can contribute to the liaisons' overall leadership.

Most liaisons were chosen by their principal due to their leadership potential in mathematics. A number of these liaisons took initiative to exhibit their leadership within their own building during the year. These leadership roles in buildings looked different. Liaisons addressed the entire staff during a staff meeting, sent emails to colleagues that contained tidbits related to the effective teaching practices, led grade-level team meetings, and served as members of the school improvement committee. Smylie (2002) suggests when leadership positions such as these are fostered, they can create powerful working relationships with the other teachers in their buildings. While the liaisons played different roles within their given contexts, each role was an important part of developing as a K–2 teacher leader of mathematics.

As the liaisons learned more about effective teaching of mathematics and had the opportunities to collaborate with colleagues of similar mindset, their overall perceptions of themselves as leaders grew. This increased self-awareness and identity as a leader was evident. While the liaisons were often reluctant to verbally self-identify as a leader, their

actions and overall disposition became more positive. This is important, as it provides evidence that investing in teacher leaders at the K–2 level in mathematics does contribute to their development as teacher leaders.

The 2018–2019 liaison experience had an impact on the self-confidence of the K–2 liaisons. This finding runs parallel to McBee's findings (2015) regarding a positive shift in how one perceives themselves as a leader. Most of the liaisons in this study did not overtly share their thoughts about their own leadership; however, it was evident that the liaisons felt more equipped as a leader of mathematics and had more confidence in their own abilities after participating in the liaison experience. As Lieberman (2015) states, teacher leaders feel more respected and tend to raise professional expectations of themselves as a result. The more the K–2 teacher leaders felt they had something to contribute in terms of leadership, they wanted to do more in terms of leadership.

The study of the 2018–2019 liaison experience provides insights into the development of K–2 teacher leaders of mathematics. If other programs in the future incorporate similar components to the programming of the liaison experience that was studied for this scholarly investigation, one can assume the teachers who participate will experience development as teacher leaders of mathematics. As I think about my greatest takeaways from this study, it is that I can confidently say that K–2 classroom teachers can be teacher leaders in mathematics. While many K–2 teachers can accomplish great things on their own, they may need to be empowered and supported as they develop as leaders. This study provides evidence that leadership development programs, such as the one I examined for this study, can contribute to teacher leadership in mathematics at the primary level.

Liaison's Current Leadership Roles

The leadership journeys of the six liaisons that participated as part of the study group have continued to unfold upon the conclusion of their liaison experience. Here, I will share what each member of the focus group is doing regarding leadership in their respective building during the 2019–2020 school year. These accounts provide insights into how the six liaisons continued to grow and exhibit leadership in their individual contexts.

Corey, a first-grade teacher, continues in the same leadership roles as they did during the 2018–2019 year. Corey is the team leader for their grade level. With this responsibility comes leading team planning meetings, as well as overseeing the overall management of the first-grade team. Corey also serves as a liaison for TeamMates, a school-based mentoring program for students. This liaison role keeps staff members informed about a community-based program where students within the school system are paired with community members who provide support and guidance for students.

Alex continues to teach first grade and serves as the team leader for this grade level. As a leader of a three-person team, Alex leads conversations about planning and other related issues related to their work. In addition to the team leader role, Alex serves as the faculty representative to the building's Parent Teacher Organization (PTO). Alex communicates information to the PTO from the building that is important to their work, as well as brings information from the PTO to staff members.

Avery is teaching kindergarten for the third year in their current building. While Avery does not hold a team leader position, Avery does contribute to team conversations and planning. Avery currently serves as the building's multicultural liaison, a

representative that works with other building representatives on issues related to equity and access. In addition to the role of liaison, Avery is a member of their building's Sunshine Committee. This committee aims to bring joy to others through kind words and gestures.

Parker had a change in their role as they moved grade levels. During the 2018–2019 school year, Parker taught second grade. This change was prompted by a reduction of the number of incoming second-grade students. Parker viewed this change as an opportunity, as they could prompt conversations about effective mathematics instruction that had not been actively engaged in previously. With the grade-level change, Parker became a grade-level PTO representative for their new grade-level team. This representative attends the monthly meetings of the PTO, communicating pertinent information when needed.

Taylor continues to teach first grade in their respective school. Taylor works closely with their team members to plan lessons that meet the needs of their diverse group of students. In terms of leadership, Taylor leads a school-wide book study. While this is a voluntary group, the participation is notable and conversations that have happened as a result have been worthwhile. Taylor has become a co-chairperson for the school's School Improvement Process (SIP) team, which is an honorable position, as this team provides leadership to the entire school in regard to improvement efforts in regard to student achievement.

During the 2019–2020 school year, Vaughn has continued in the same leadership positions as they had the previous year. Vaughn leads the building's SIP team. Through this role, Vaughn provides leadership for the entire staff as they guide efforts to raise

student achievement in different content areas. Along with serving as SIP team leader, Vaughn acts as their grade-level team leader. In this role Vaughn leads the teaching team as it collaborates to provide the best education they can for their students.

The six focus group participants continue to exhibit leadership during the 2019–2020 school year. Many have extended the leadership roles they had during the previous year into the new school year. These former math liaisons serve as team leaders, committee members, liaisons, and school improvement chairpersons. Even though their formal roles in mathematics leadership may have ended with the conclusion of the math liaison experience, the former liaisons continue to serve as teacher leaders in mathematics. Through my role as K–2 Mathematics Coordinator, I have had the opportunity to observe conversations these leaders are having with teammates and field questions they are asking about mathematics. These actions are visible signs of teacher leadership.

What I Learned

This research study added to my knowledge of working with teacher leaders. I gained more understanding of what contributes to the growth of primary teacher leaders in mathematics. I learned teachers at the primary level develop as teacher leaders when they have had experience navigating productive struggle in mathematics, supportive administration, view leadership as worthwhile, and characterizes themselves as a leader. This new knowledge of K–2 teacher leadership will be useful as I continue to work with and foster more teacher leaders of mathematics at the primary level in the future.

One thing I am taking away from this study is that time is important. The liaisons communicated they would have liked more time to interact with the content from *Taking*

Action: Implementing Effective Mathematics Teaching Practices in K–Grade 5 (Huinker & Bill, 2017). During the 2018–2019 school year, the four liaisons meetings were held in September, November, January, and March. The liaisons suggested that moving the first two meetings to earlier in the school year would have given them more time to apply their learning to their own contexts. This suggested change is supported by the National Research Council's (2001) suggestions that short-term, fragmented professional development is ineffective in fostering teacher change. As a result of the liaisons' feedback, the first two liaison meetings for the 2019–2020 school year were moved to August and September, which extended the time the liaisons had to think about an effective teaching practice and carry out the instructional strategy in their own teaching from four to six months. Moving the two initial meetings to right away in the school year would provide more time for the second group of liaisons to implement their new learning into their own classrooms.

I learned clearer communication may be needed with principals to clearly convey the expectations of the liaison role. When principals were choosing who their building's representative for the 2018–2019 school year, many of them chose teachers who had been liaisons in the past. This was a reasonable decision, as historically teachers have remained in a liaison position several years. However, with the shift in structure in the liaison experience it may be important for principals to consider choosing a teacher from their building who they feel is willing to learn and grow professionally to embrace the role of a teacher leader of mathematics. Additionally, the liaison experience will be replicated from year to year, so choosing different teachers to participate will empower a number of teachers to become teacher leaders. Looking ahead to the future, I believe it

will be important to be intentional and purposeful with communication about the liaison role to assist principals in choosing teachers to participate from their respective buildings.

While working with the liaisons, I learned that different liaisons needed different types of support. Some liaisons were self-starters and took initiative on their own to engage in leadership tasks. Others needed more support and encouragement. Through this study, I learned that it may be necessary to be more explicit in what the liaisons could do in terms of leadership within their respective buildings. One liaison suggested "an assignment" would have pushed them to actively partake in leadership within their context. Perhaps assigning a task, or providing a gentle nudge, would have encouraged some liaisons to pursue a new leadership venture that they may not have initiated on their own. Additionally, it may be helpful to ask a former liaison to share their experiences with the new liaison group. By doing so, the new liaisons could reflect upon potential leadership opportunities within their own contexts.

In addition to varying degrees of support, I learned that I need to be more direct regarding expectations of the liaison experience. The liaisons who grew the most seemed to be self-starters and took initiative on their own. Many asked for support or sought advice as they took risks as leaders. There were some liaisons that did not seem to grow as much as this first group of liaisons regarding teacher leadership. Perhaps it was that they did not know what to do or did not have the confidence in their own abilities. With future liaison groups, I want to communicate the expectations more effectively and ensure each liaison has multiple follow-ups to the one-on-one meetings and exhibits some type of leadership in respect to mathematics education. This initial round of the program, I felt as if I did not want to push the liaisons too much. I wanted to maintain a level of

trust and safety. However, for them to get as much out of the experience I should have held each and every one to high expectations and provide the level of support they needed, just as a classroom teacher would do for their students.

As I reflect upon the liaison experience, I believe leadership could have been more of a focus. While different types of leadership in mathematics were discussed during the third meeting, it did not feel as if it was enough. Moving forward, it might be beneficial to have the leadership conversations more defined. Perhaps a component of leadership could be infused into each meeting. Short readings about leadership could be incorporated into the program. It might be that liaisons from the past come and share their accounts of leadership experiences. By intentionally incorporating more discussion of leadership into the program, perhaps the liaisons would more easily recognize their own leadership capabilities and understand what opportunities there are for them to exhibit their leadership.

Just as a teacher reflects upon a lesson and thinks about what went well, what could have gone better, and what changes are necessary, I have done the same regarding the 2018–2019 liaison experience. These changes were implemented with the second liaison group during the 2019–2020 school year with positive results. Unfortunately, the global pandemic in spring 2020 prohibited this new liaison group from completing their experience but implementing the changes as a result of my initial learning seemed to be worthwhile.

Suggestions for Future Research

The purpose of this research study was to gain a deeper understanding of the common characteristics of teachers as they developed skills as a teacher leader as a result

of being involved in a specialized professional learning opportunity offered by a large, urban school district. At the conclusion of this scholarly investigation, I am walking away with insights to my research questions:

RQ_1: What opportunities and contextual factors do K–2 teacher leaders identify as contributing to their growth as teacher leaders in mathematics?

RQ_2: In what ways does a structured professional learning opportunity promote teacher leadership in K–2 teachers?

I have developed greater insights in regard to the opportunities and contextual factors that K–2 teacher leaders believe contribute to their growth as teacher leaders and have more knowledge of how a structured professional learning opportunity promotes teacher leadership in K–2 teachers. With this newly acquired knowledge comes more wonderings as good research questions leave more questions than answers.

While this study was conducted over the course of the year, the duration of this study left me thinking about how more time might contribute to the development of leadership in primary teachers. Would it make a difference if the teachers in this study participated as liaisons for more than a year? What if these teachers continued as liaisons over a duration of three years? Another study that would follow liaisons over a longer period of time may provide greater insights into the long-range development of leadership.

Principals were asked to participate in this study by completing a similar pre-survey to the survey liaisons completed as they began the professional development opportunity. Unfortunately, the return rate of principal surveys was not as anticipated. This unexpected participation rate may have been due to the time of year the survey was

sent or other demands on the principals' time. The small amount of data collected from principals could not be used to draw any conclusions in relation to my research questions. This still leaves me to ponder about the principals' perceptions of the teacher leaders from their respective buildings. How did the principals originally see the teacher they chose as a liaison in regard to leadership? Did they see shifts in leadership in this teacher over the course of the year in respect to leadership of mathematics? What strengths did the principal see as the greatest assets within this teacher leader that could potentially impact the growth of other staff members in terms of mathematics? Studying the principals' thoughts and feelings related to teacher leadership would bring more insights to teacher leadership through the lens of building administrators.

While this study examined the development of six liaisons, following one liaison intensely through a single case study may have provided a richer description of one liaison's development as a teacher leader. Gathering information through an interview, survey, and informal data collection provided valuable insights; however, I am left thinking about the specific details of one teacher leader's journey of leadership. Following one liaison intensively may have offered an alternate perspective to leadership than what was found as a result of this particular investigation.

I served as both a facilitator of the liaisons and as the researcher. During the study, I began to think about my own work in respect to contributing to the development of the liaisons in regard to leadership in mathematics education. Did any of my actions as a facilitator of the liaison group make a difference in the leadership of others? Which aspects of my own leadership helped or hindered the development of leadership in others? What did I do that the liaisons found to be most beneficial to support their growth

as leaders? Examining how my actions potentially promoted the leadership development in others would provide me with a greater understanding of the effectiveness of my work.

One liaison suggested an assignment may have encouraged them to pursue a new leadership venture that they may not have initiated on their own. I wonder if assigning a certain task for the liaisons to complete as part of their experience may have encouraged the liaisons to seek out other leadership possibilities. What if each liaison was charged with a certain task such as presenting one aspect of the teaching practice they studied to their staff during a staff meeting? What if each liaison was asked to meet with their principal and determine something the liaison could do that would contribute to the staff's collective knowledge about teaching mathematics? Would the liaisons be ready to lead conversations with their staff to come to some whole school agreements about mathematics instruction (Karp et al., 2020)? Studying how liaisons respond to being assigned a specific leadership task may provide more insights into how teacher leaders develop and/or what support they might need as they begin to exercise their leadership.

Finally, I wonder if the structure of the group had been altered if it would have impacted the growth of the liaisons as teacher leaders. Would there have been more growth in leadership in a liaison if each building were able to have two primary teachers participate? What if the liaison group solely consisted of teachers from kindergarten, first, and second grade? Would this different make-up of the group see more growth within the teacher leaders' development? Might this more defined group help the liaisons develop more tight-knit relationships, thus impacting their confidence as teacher leaders? Studying a different make-up of liaisons may provide additional insights into what liaisons need as they develop as teacher leaders.

As I mentioned previously, solid research questions and corresponding study produce answers and insights to the phenomenon being examined. However, while clarity is often gained on one idea, it can also raise related questions. This is what this study did for me. It raised more wonderings in regard to teacher leadership that may be worthy of investigating in the future.

Conclusion

District leaders, as well as others, need to continue to cultivate, nurture, and sustain teacher leadership in mathematics education within an early elementary context. This study found K–2 teacher leaders of mathematics tend to be more successful if they have had an experience with struggling in mathematics, have supportive administrators, view leadership in a positive way, and characterize themselves as a leader. These teacher leaders benefit from learning opportunities in which they can deepen their understanding of mathematics pedagogy and strengthening relationships with other teacher leaders. Professional learning opportunities that are mindful of these findings have the potential to contribute to the development of more K–2 teacher leaders in mathematics.

Developing elementary mathematics teacher leaders has the potential to create a largely untapped resource to contribute to the instructional improvement and increased student achievement in elementary schools. The liaison group I studied in my district during the 2018–2019 school year, did just this. The liaisons, or teacher leaders, were more empowered to spark conversations in their respective buildings regarding the effective teaching practices. As a result, more teachers were thinking about mathematics teaching and learning.. As one liaison described,

It’s been amazing. It was a really good six months. I think anytime we can get people together to talk about what we do and have conversations about the reality of what is happening is good. Anytime we can get educators together to talk about education, great things are going to happen.

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Appendix A: Expectations of District Liaisons

Liaisons are paid positions developed to be a primary resource between the district curriculum departments and the buildings. Though important differences in responsibilities can be expected between curricular areas, there are common expectations for these roles.

1. Liaisons are required to attend meetings as scheduled for their assigned curricular area.
    a. If a liaison is unable to attend a scheduled meeting, he/she is responsible for arranging a replacement to attend in his/her place.
2. During meetings, Liaisons will provide feedback and receive critical information related to curriculum, assessments, and other logistical information.
3. In this role, liaisons receive professional learning opportunities to build capacity in the content area as well as their own leadership skills.
4. Liaisons are responsible for developing a consistent mode of communication for articulating all information shared during the meeting with the teachers in their department and the administration at their building.
5. Liaisons will have related professional responsibilities outside of district meeting time (e.g., maintaining building equipment, collecting feedback, preparation for active participation)

Appendix B: Introductory and Reminder Email for Participants

Introductory Email

Dear K-2 Math Liaison,

The math department is delighted that you will be a K-2 math liaison for the 2018-2019 school year! As you may know, this role will look slightly different than it has in the past. The buildings have been split into two groups with half having a K-2 representative and the other half with a 3-5 representative. Our group will meet four times across the year at The Don Clifton Center. The dates are:

September 19, 2018
November 14, 2018
January16, 2019
March 20, 2019

We will begin promptly at 4:15 p.m. and end at 5:45 p.m.. In addition, you will be asked to prepare for active engagement in the meetings which will include professional readings, various written tasks, and meet one-on-one with someone from the math department. District expectations for curriculum liaisons are attached for your review.

The systematic change in the structure of liaisons is due to the department's mission of providing opportunities for classroom teachers to engage in professional learning opportunities in order to build capacity in mathematics as well as develop the leadership skills. Together, we will reflect upon current pedagogical practices and grow as professionals by working together as a collaborative community.

In preparation for our first time together, I am asking that all math liaisons respond to the math story prompts which are attached to this email. This task should take you no longer than 45 minutes to complete. Short answers for each statement are sufficient, however please make sure you provide enough information to paint a picture of your journey as a math learner and teacher. You can record your answers in a google doc (please title with your name) and place them in this folder: XXXXX

I look forward to collaborating with you this year. If you have any questions regarding this new role, please do not hesitate to contact me.

Susie Katt XXXX@gmail.com
K-2 Mathematics Coordinator XXX-XXX-XXXX

Reminder Emails

Reminder: Math Story

Dear [name],
This is just a quick reminder that I am asking K-2 math liaisons to write a math story prior to our first session on September 19. I know this is a busy time, but I would really appreciate it if you could complete this task prior to the meeting, as we will be discussing our responses during our time together.

Thanks!
Susie

Reminder: One-on-one meeting

Dear [name],
This is just a quick reminder that I am asking K-2 math liaisons to meet with me one-on-one at least once during each semester of this school year. I would really appreciate it if you could reply to the email with potential dates and times by [DATE]. Once I hear from you, I will get back to you with a date and time that works with my schedule as well. I look forward to meeting with you.

Thanks!
Susie

Appendix C: Mathematics Story Prompts

As a math liaison, you are being asked to document aspects of your personal mathematics story. This should take you roughly 45 minutes to complete. Please provide brief answers for the following statements, making sure you provide enough information to paint a picture of your journey as a mathematics learner and teacher.

1. Describe your experience as a learner of mathematics in elementary, middle and high school. What do you remember?

2. Tell about your experience with mathematics in college and/or graduate school.

3. How would you describe yourself as a mathematics learner?

4. What was one of the most memorable "highs" you've had as a mathematics learner?

5. What was one of the most memorable "lows" you've had as a mathematics learner?

6. Describe your pre-service experience with mathematics classes in the context of educational training.

7. How would you describe yourself as a math teacher?

8. What was one of the most memorable "highs" you've had as a teacher of mathematics?

9. What was one of the most memorable "lows" you've had as a teacher of mathematics?

10. How do you see your influence on mathematics at your respective grade level? In your building?

11. Who do you talk to most often about mathematics? Please rank order from 1-5.
    __principal
    __assistant principal/coordinator
    __other teachers in your grade level at your school
    __teachers of another grade level at your school
    __other teachers in your grade level at a different school
    __teachers of another grade level at a different school
    __special education teachers
    __paraprofessionals
    __parents
    __others

12. Talk about the types of conversations you have with the people you marked above.

Appendix D: Survey for Teacher Participants

Teacher Leadership Survey

On the following pages is a series of statements. They have been organized in a way which permits you to indicate the extent to which you agree or disagree with the ideas expressed. There is no "right" or "wrong" answer. The only correct responses are those that are true for you. Whenever possible, let the things that have happened to you help you make a choice. Do not spend much time with any one statement, but be sure to answer every statement. Work quickly, but carefully. Your responses will be kept confidential in all reports.

NAME_____

1. Please indicate the extent to which you presently do the following related to a collaborative culture:					
	Not At All (1)	(2)	Moderate Extent (3)	(4)	Great Extent (5)
a. Utilize group processes to help colleagues work collaboratively to solve problems, make decisions, manage conflict, and promote meaningful change.					
b. Model effective skills in listening, presenting ideas, leading discussions, clarifying, mediating, and identifying the needs of self and others in order to advance shared goals and professional learning.					
c. Employ facilitation skills to create trust among colleagues, develop collective wisdom, build ownership and action that supports student learning.					
d. Strive to create an inclusive culture where diverse perspectives are welcomed in addressing challenges.					
e. Use knowledge and understanding of different backgrounds, ethnicities, cultures, and languages to promote effective interactions among colleagues.					

2. Please indicate the extent to which you presently do the following related to accessing and using research:					
	Not At All (1)	(2)	Moderate Extent (3)	(4)	Great Extent (5)
a. Assist colleagues in accessing and using research in order to select appropriate strategies to improve student learning.					
b. Facilitate the analysis of student learning data, collaborative interpretation of results, and application of findings to improve teaching and learning.					
c. Support colleagues in collaborating with the higher education institutes and other organizations engaged in researching critical educational issues.					
d. Teach and support colleagues to collect, analyze, and communicate data from their classrooms to improve teaching and learning.					

3. Please indicate the extent to which you presently do each of the following related to promoting professional learning:					
	Not At All (1)	(2)	Moderate Extent (3)	(4)	Great Extent (5)
a. Collaborate with colleagues and school administration to plan professional learning that is team-based, job-embedded, sustained over time, aligned with content standards, and linked to school/district improvement goals.					
b. Use information about adult learning to respond to the diverse learning needs of colleagues by identifying, promoting, and facilitating varied and differentiated professional learning.					
c. Facilitate professional learning among colleagues.					
d. Identify and use appropriate technologies to promote collaborative and differentiated professional learning.					

e. Work with colleagues to collect, analyze, and disseminate data related to the quality of professional learning and its effect on teaching and student learning.					
f. Advocate for sufficient preparation, time, and support for colleagues to work in teams to engage in job-embedded professional learning.					
g. Provide constructive feedback to colleagues to strengthen teaching practice and improve student learning.					
h. Use information about emerging education, economic, and social trends in planning and facilitating professional learning.					

***4. Please indicate the extent to which you presently do the following related to a facilitating improvements*:**					
	Not At All (1)	(2)	Moderate Extent (3)	(4)	Great Extent (5)
a. Facilitate the collection, analysis, and use of classroom- and school-based data to identify opportunities to improve curriculum, instruction, assessment, school organization, and school culture.					
b. Engage in reflective dialog with colleagues based on observation of instruction, student work, and assessment data and helps make connections to research-based effective practices.					
c. Support colleagues' individual and collective reflection and professional growth by serving in roles such as mentor, coach, and content facilitator.					
d. Serve as a team leader to harness the skills, expertise, and knowledge of colleagues to address curricular expectations and student learning needs.					

e. Use knowledge of existing and emerging technologies to guide colleagues in helping students skillfully and appropriately navigate the universe of knowledge available on the Internet, use social media to promote collaborative learning, and connect with people and resources around the globe.					
f. Promote instructional strategies that address issues of diversity and equity in the classroom and ensures that individual student learning needs remain the central focus of instruction.					

5. Please indicate the extent to which you presently do the following related to promoting the use of assessments and data:

	Not At All (1)	(2)	Moderate Extent (3)	(4)	Great Extent (5)
a. Increase the capacity of colleagues to identify and use multiple assessment tools aligned to state and local standards.					
b. Collaborate with colleagues in the design, implementation, scoring, and interpretation of student data to improve educational practice and student learning.					
c. Create a climate of trust and critical reflection in order to engage colleagues in challenging conversations about student learning data that lead the solutions to identified issues.					
d. Work with colleagues to use assessment and data findings to promote changes in instructional practices or organizational structures to improve student learning.					

6. Please indicate the extent to which you presently do the following related to improving outreach and collaboration:					
	Not At All (1)	(2)	Moderate Extent (3)	(4)	Great Extent (5)
a. Use knowledge and understanding of the different backgrounds, ethnicities, cultures, and languages in the school community to promote effective interactions among colleagues, families, and the larger community.					
b. Model and teach effective communication and collaboration skills with families and other stakeholders focused on attaining equitable achievement for students of all backgrounds and circumstances.					
c. Facilitate colleagues' self-examination of their own understandings of community culture and diversity and how they can develop culturally responsive strategies to enrich the educational experiences of students and achieve high levels of learning for all students.					
d. Develop a shared understanding among colleagues of the diverse educational needs of families and community.					
e. Collaborate with families, communities, and colleagues to develop comprehensive strategies to address the diverse educational needs of families and the community.					

7. Please indicate the extent to which you presently do the following related to advocating for student learning and the profession.					
	Not At All (1)	(2)	Moderate Extent (3)	(4)	Great Extent (5)
a. Shares information with colleagues within and/or beyond the district regarding how local, state, and national trends and policies can impact classroom practices and expectations for student learning.					
b. Works with colleagues to identify and use research to advocate for teaching and learning processes that meet the needs of all students.					
c. Collaborates with colleagues to select appropriate opportunities to advocate for the rights and/or needs of students, to secure additional resources within the building or district that support student learning, and to communicate effectively with targeted audiences such as parents and community members.					
d. Advocates for access to professional resources, including financial support and human and other material resources, that allow colleagues to spend significant time learning about effective practices and developing a professional learning community focused on school improvement goals.					
e. Represents and advocates for the profession in contexts outside of the classroom.					

Appendix E: Consent Form for Teacher Participants

University of Nebraska Lincoln

TEACHER LEARNING AND TEACHER EDUCATION

Teacher Informed Consent Form

Teacher Leadership Study

This is a research project with the goal to better understand the leadership of teachers of mathematics in XXXXXXX. You are invited to participate because you have been selected as a 2018-2019 math liaison. If you have any questions please do not hesitate to ask.

Participation in this study will occur during 2018-2019 school year. In this study you will complete two surveys and write a short math story. Questions on the survey will inquire about your perception of your own leadership in mathematics as serving as a generalist in an elementary classroom. The math story will concentrate on your mathematical journey as a math learner and teacher. The math story will take no longer 45 minutes to complete. Observations will be made during the math liaison and one-on-one meetings. These components are expectations of all math liaisons, as they will be discussed during the liaison meetings. Only the data from those who give consent will be analyzed as part of this study. Some participants may be asked to participate in a semi-structured interview of up to 60 minutes in the spring, which would be beyond the regular expectations of being a math liaison. If you are one to be selected, this will be strictly voluntary. Interviews will be audio-recorded for note-taking purposes.

Your willingness to participate or not in this study will have no effect on your math liaison role, your teaching position, or employment within the district.

There are no risks associated with this research. By participating in the study, you may find the various opportunities to reflect on your own work and leadership in regards to elementary mathematics to be an interesting experience. The information gained in this study may help me better understand how teacher leaders develop in a district and what supports other teachers may need to emerge as leaders in the future.

Any information obtained during this study that could identify you will be kept strictly confidential. The data will be stored in the investigator's home office and will only be seen by the investigator and her advisor during the study and for three years after the

study is complete. The information obtained in this study may be published in educational journals or presented at educational meetings but your identity will be kept strictly confidential; data will be aggregated as much as possible. In instances where data are not reported as aggregated, pseudonyms for teachers, schools, and school districts will be used and all other identifying information will be disguised to protect your identity. The audiotapes will be destroyed after transcription and analysis.

You may ask any questions regarding this research and have those questions answered before agreeing to participate in or during the study. You may call the investigator at any time, Susan Katt, personal phone (XXX) XXX-XXXX or Dr. Wendy Smith (XXX) XXX-XXXX. If you have any questions concerning your rights as a research participant that have not been answered by the investigator or to report any concerns about the study, you may contact the University of Nebraska-Lincoln Institutional Review Board (UNL IRB), telephone (XXX) XXX-XXXX.

The University of Nebraska-Lincoln wants to know about your research experience. This 14-question, multiple-choice survey is anonymous. This survey should be completed after your participation in this research. Please complete this optional online survey at: https:XXXXX

You are free to decide not to participate in this study or to withdraw at any time without adversely affecting your relationship with the investigators, the University of Nebraska-Lincoln, or XXXXX. Your decision will not result in any loss of benefits to which you are otherwise entitled. You are voluntarily making a decision whether or not to participate in this research study. Your signature certifies that you have decided to participate having read and understood the information presented. You will be given a copy of this consent to keep.

o I agree to be audiotaped as part of research-related interviews if selected.

_____ Signature of Research Participant

Susan Katt, Principal Investigator
Dr. Wendy Smith, Secondary Investigator

_____
Printed Name Date

Phone: (XXX) XXX-XXXX Phone: (XXX) XXX-XXXX

118 Henzlik Hall / Lincoln, NE 68588-0355 / (XXX) XXX-XXXX/ tltestaff@unl.edu

Appendix F: Introductory Letter and Email Reminder for Principals

University of Nebraska Lincoln
TEACHER LEARNING AND TEACHER EDUCATION

October 22, 2018

Dear Principals,

The 2018-2019 Math Liaison role is slightly different as it has been in in the past. Half of the buildings have a K-2 representative, while the other half have a 3-5 representative. The systematic change in the structure of liaisons is due to the department's mission of providing opportunities for classroom teachers to engage in professional learning opportunities to build capacity in mathematics as well as develop leadership skills. The group will reflect upon current pedagogical practices and grow as professionals by working together as a collaborative community.

It is a vision of the math department to be able to provide additional learning opportunities for teachers in order to develop leadership in the years to come. Therefore, it is important they closely examine the work and make data-based decisions to move forward. In collaboration with the University of Nebraska-Lincoln, the math department would like to study this newly structured math liaison opportunity to see how it may potentially impact teacher leadership within the primary grades in the district.

I currently serve as the chairman for Susie Katt's doctoral committee. This study will be Susie's dissertation work, as she is interested in the development of teacher leaders in the primary grades in mathematics. I will be assisting her during the study and will work to maintain confidentiality of participants throughout the research process.

A consent form is included for your review, which outlines the specifics of this study. Please read this carefully. If you have any questions, do not hesitate to ask. If you chose not to participate, your decision will not impact your math liaison's role in any way.

If you are willing to be a participant in the study, please sign and date one of the consent forms. The second copy is yours to keep. Please allow 15-20 minutes to complete the survey and consent form. We would ask that you promptly return the completed survey and signed consent form to Dr. Smith via the self-addressed envelope.

In order to move forward with this study in a timely manner, we ask that you return the survey by Friday, November 9, 2018. Susie and I know your schedules are very busy, so we greatly appreciate your consideration of participating in this study.

Dr. Wendy Smith, Secondary Investigator
Phone: (XXX) XXX-XXXX
XXXXXXX@gmail.com

Susan Katt, Principal Investigator
Phone: (XXX) XXX-XXXX
XXXXXXX@gmail.com

Reminder Email

Dear [name],

This is just a quick reminder that I am asking the principals of K-2 math liaisons to complete a survey. I know this is a busy time, but I would really appreciate it if you could [return the survey by [DATE].

Thanks!

Susie

Appendix G: Consent Form for Principals

Principal Informed Consent Form Teacher Leadership Study

This is a research project with the goal to better understand the capacities of teachers who develop as teacher leaders of mathematics in XXXXXXX. You are invited to participate as your Math Liaison for the 2018-2019 school year has been asked to be a part of this study. If you have any questions please do not hesitate to ask.

In this study, you will be asked to use take one survey to indicate your perception of the teacher in your building in regard to leadership. The survey will take no longer than 15 minutes to complete.

There are no risks associated with this research. You may find the opportunity to reflect on teacher leadership in regard to elementary mathematics to be an interesting experience. The information gained in this study may help me better understand what it takes to help the development of teacher leaders and what supports other teachers may need to emerge as leaders in the future.

Any information obtained during this study that could identify you will be kept strictly confidential. The data will be stored in the investigator's home office and will only be seen by the investigator and her advisor during the study and for three years after the study is complete. The information obtained in this study may be published in educational journals or presented at educational meetings but your identity will be kept strictly confidential; data will be aggregated as much as possible. In instances where data are not reported as aggregated, pseudonyms for teachers, schools, and school districts will be used and all other identifying information will be disguised to protect your identity.

You may ask any questions regarding this research and have those questions answered before agreeing to participate in or during the study. You may call the investigator at any time, Susie Katt, personal phone (XXX) XXX-XXXX or Dr. Wendy Smith (XXX) XXX-XXXX. If you have any questions concerning your rights as a research participant that have not been answered by the investigator or to report any concerns about the study, you may contact the University of Nebraska-Lincoln Institutional Review Board (UNL IRB), telephone (XXX) XXX-XXXX.

You are free to decide not to participate in this study or to withdraw at any time without adversely affecting your relationship with the investigators, the University of Nebraska-Lincoln, or XXXXX. Your decision will not result in any loss of benefits to which you are otherwise entitled. You are voluntarily making a decision whether or not to participate in this research study. Your signature certifies that you have decided to participate having read and understood the information presented. You will be given a copy of this consent to keep.

_____ Signature of Research Participant

Susie Katt, Principal Investigator Phone (XXX) XXX-XXXX
Dr. Wendy Smith, Secondary Investigator Phone (XXX) XXX-XXXX

_____ _____ Printed Name Date

Appendix H: Survey for Principal Participants

You will complete this survey, thinking about this year's elementary math liaison in your building. On the following pages is a series of statements. The questions have been set up in a way which permits you to indicate the extent to which you agree or disagree with the ideas expressed. There is no "right" or "wrong" answer. The only correct responses are those that are true for how you perceive the leader who you are considering. Do not spend much time with any one statement, but be sure to answer every statement. Work quickly, but carefully. Your responses will be kept confidential in all reports.

NAME_____

1. Please indicate the extent to which your school's identified liaison presently does the following related to a collaborative culture:					
	Not At All (1)	(2)	Moderate Extent (3)	(4)	Great Extent (5)
a. Utilize group processes to help colleagues work collaboratively to solve problems, make decisions, manage conflict, and promote meaningful change.					
b. Model effective skills in listening, presenting ideas, leading discussions, clarifying, mediating, and identifying the needs of self and others in order to advance shared goals and professional learning.					
c. Employ facilitation skills to create trust among colleagues, develop collective wisdom, build ownership and action that supports student learning.					
d. Strive to create an inclusive culture where diverse perspectives are welcomed in addressing challenges.					
e. Use knowledge and understanding of different backgrounds, ethnicities, cultures, and languages to promote effective interactions among colleagues.					

2. Please indicate the extent to which your school's identified liaison presently does the following related to accessing and using research:					
	Not At All (1)	(2)	Moderate Extent (3)	(4)	Great Extent (5)
a. Assist colleagues in accessing and using research in order to select appropriate strategies to improve student learning.					
b. Facilitate the analysis of student learning data, collaborative interpretation of results, and application of findings to improve teaching and learning.					
c. Support colleagues in collaborating with the higher education institutes and other organizations engaged in researching critical educational issues.					
d. Teach and support colleagues to collect, analyze, and communicate data from their classrooms to improve teaching and learning.					

3. Please indicate the extent to which your school's identified liaison presently does each of the following related to promoting professional learning:					
	Not At All (1)	(2)	Moderate Extent (3)	(4)	Great Extent (5)
a. Collaborate with colleagues and school administration to plan professional learning that is team-based, job-embedded, sustained over time, aligned with content standards, and linked to school/district improvement goals.					
b. Use information about adult learning to respond to the diverse learning needs of colleagues by identifying, promoting, and facilitating varied and differentiated professional learning.					
c. Facilitate professional learning among colleagues.					

d. Identify and use appropriate technologies to promote collaborative and differentiated professional learning.					
e. Work with colleagues to collect, analyze, and disseminate data related to the quality of professional learning and its effect on teaching and student learning.					
f. Advocate for sufficient preparation, time, and support for colleagues to work in teams to engage in job-embedded professional learning.					
g. Provide constructive feedback to colleagues to strengthen teaching practice and improve student learning.					
h. Use information about emerging education, economic, and social trends in planning and facilitating professional learning.					

***4. Please indicate the extent to which your school's identified liaison presently does the following related to a facilitating improvements*:**					
	Not At All (1)	(2)	Moderate Extent (3)	(4)	Great Extent (5)
a. Facilitate the collection, analysis, and use of classroom- and school-based data to identify opportunities to improve curriculum, instruction, assessment, school organization, and school culture.					
b. Engage in reflective dialog with colleagues based on observation of instruction, student work, and assessment data and helps make connections to research-based effective practices.					
c. Support colleagues' individual and collective reflection and professional growth by serving in roles such as mentor, coach, and content facilitator.					
d. Serve as a team leader to harness the skills, expertise, and knowledge of colleagues to address curricular expectations and student learning needs.					

e. Use knowledge of existing and emerging technologies to guide colleagues in helping students skillfully and appropriately navigate the universe of knowledge available on the Internet, use social media to promote collaborative learning, and connect with people and resources around the globe.					
f. Promote instructional strategies that address issues of diversity and equity in the classroom and ensures that individual student learning needs remain the central focus of instruction.					

5. Please indicate the extent to which your school's identified liaison presently does the following related to promoting the use of assessments and data:					
	Not At All (1)	(2)	Moderate Extent (3)	(4)	Great Extent (5)
a. Increase the capacity of colleagues to identify and use multiple assessment tools aligned to state and local standards.					
b. Collaborate with colleagues in the design, implementation, scoring, and interpretation of student data to improve educational practice and student learning.					
c. Create a climate of trust and critical reflection in order to engage colleagues in challenging conversations about student learning data that lead the solutions to identified issues.					
d. Work with colleagues to use assessment and data findings to promote changes in instructional practices or organizational structures to improve student learning.					

6. Please indicate the extent to which your school's identified liaison presently does the following related to improving outreach and collaboration:					
	Not At All (1)	(2)	Moderate Extent (3)	(4)	Great Extent (5)
a. Use knowledge and understanding of the different backgrounds, ethnicities, cultures, and languages in the school community to promote effective interactions among colleagues, families, and the larger community.					
b. Model and teach effective communication and collaboration skills with families and other stakeholders focused on attaining equitable achievement for students of all backgrounds and circumstances.					
c. Facilitate colleagues' self-examination of their own understandings of community culture and diversity and how they can develop culturally responsive strategies to enrich the educational experiences of students and achieve high levels of learning for all students.					
d. Develop a shared understanding among colleagues of the diverse educational needs of families and community.					
e. Collaborate with families, communities, and colleagues to develop comprehensive strategies to address the diverse educational needs of families and the community.					

7. Please indicate the extent to which your school's identified liaison presently does the following related to advocating for student learning and the profession.					
	Not At All (1)	(2)	Moderate Extent (3)	(4)	Great Extent (5)
a. Shares information with colleagues within and/or beyond the district regarding how local, state, and national trends and policies can impact classroom practices and expectations for student learning.					
b. Works with colleagues to identify and use research to advocate for teaching and learning processes that meet the needs of all students.					
c. Collaborates with colleagues to select appropriate opportunities to advocate for the rights and/or needs of students, to secure additional resources within the building or district that support student learning, and to communicate effectively with targeted audiences such as parents and community members.					
d. Advocates for access to professional resources, including financial support and human and other material resources, that allow colleagues to spend significant time learning about effective practices and developing a professional learning community focused on school improvement goals.					
e. Represents and advocates for the profession in contexts outside of the classroom.					

Appendix I: Semi-structured Interview Protocol

Structure

- Interviews will be one-on-one between the researcher and the interviewee.
- The interviews will take place in a location of choice of the interviewee.
- The interviews will be audio recorded.
- The interviews are expected to take up to 30 minutes.
- The interviews will be semi-structured, although it will be critical that the interviewer go through all of the questions in the protocol.

Protocol

Introduction

Thank you for taking time out of your busy schedule to meet with me today. I am interested in learning more about your development as a teacher leader in mathematics, so I am going to ask you a few questions about your math story and journey as a leader.

I will be asking you a series of questions. Our conversation will be audio recorded for purposes of data collection. Please know that I will be the only one listening to the recordings, as I will transcribe your interview at a later date. All personal information will be kept confidential.

Your needs are important to me. If there is a particular question you would rather not answer, please let me know.

Do you have any questions about this process? If not, may I have your permission to start the recording and proceed to the interview questions?

Conclusion

I appreciate you taking the time today to talk to me about your leadership journey and work. I enjoyed hearing your personal views and appreciate your cooperation in regard to this project. Thank you again.

Materials

*audio recording device
*interview protocol
*interview questions
*pen/pencil
*note paper

Interview Questions

1. For the math liaison activity, you shared aspects of your personal math story. Describe one event, from any point in your life, that stands out in your memory as being the most important or significant with respect to your math story.

2. Looking back at your math story, please identify the single person, group of persons, or organization/institution that has had or have had the greatest positive influence on your perspective of math. Please describe this person, group, or organization and the way in which he, she, it or they have had a positive impact on your story.

3. What will the next chapter of your math story look like? What will you look like as a teacher of math? What will you look like as a learner of math?

4. Please talk to me about the contexts of your school. [Probes]

    a. Instructional coaches (Does your school have a coach? If so, what types of role does he/she have? How do you work with the coach?)
    b. Administration (What roles do principals/assistant principals/coordinators have?)
    c. School climate (Are teachers here generally supportive of one another? Do teachers regularly observe each other? Plan together? Talk about student issues? Talk about learning goals for students?)
    d. What kinds of professional development for mathematics does your building typically provide?

5. What do you think defines someone as a teacher leader?

6. Tell me about how you view yourself a teacher leader in mathematics.

7. Describe how your view may have changed over the course of this year due to your participation as a K-2 Math Liaison.

8. In what ways do you think others in your building (peers, administrators, etc.) see you as a teacher leader of mathematics?

9. What are some of the activities in which you engage that you think represent your work as a teacher leader of mathematics? What are the challenges? What are your strengths?

10. How do you identify opportunities for teacher leadership in which to engage? [Probe: Do you get approached with leadership opportunities, such as by your principal or district math department?]

11. When you begin a teacher leadership effort, what are some of the things you look at / think about to ensure that the effort is successful?

12. Describe a situation in which your leadership effort in mathematics was most successful and how you responded to this.

13. What are some of the tensions/challenges you experience as a teacher leader of mathematics in your building?

14. What experiences do you feel were most significant in developing you into a teacher leader of mathematics?

15. How would you describe your overall journey as a teacher leader in mathematics?

16. Please talk a little bit about the professional relationships you developed over this year as a result of your participation as a K-2 math liaison.

17. What do you see as the most influential components of the Math Liaison experience in helping you grow as a learner? Teacher? Leader?

18. What do you see yourself doing in the future to contribute to your professional growth and leadership development in mathematics?

19. Is there anything additional you would like to share regarding your development and work as a teacher leader within your building?

Appendix J: Emails for Interview Participants

Initial Email

You have been selected to be interviewed for the teacher leader research study. This interview is strictly voluntary, and is in addition to the expectations of being a math liaison. The interview will last approximately 45-60 minutes and be audio-recorded for note-taking purposes. The questions that you will be asked to answer will be sent to you prior to the interview.

The interview can take place in a public location of your choosing as you may prefer to meet in your classroom or at a local coffee shop. Another option would be to meet virtually via Zoom.

I know the end of school is a busy time, however I would like to complete the interviews during the month of May if possible. In your reply, please indicate if you would be willing to be interviewed, where you would like the interview to take place or if you would prefer to meet via Zoom, and a few dates and times when you would be available. My schedule should be open most days before or after school and during the evening. I appreciate your prompt reply as this will be helpful for planning purposes.

If you have any questions, please do not hesitate to contact me at XXXXX@gmail.com. Thank you in advance!

Susie

Second Email

The questions are below. I may add one or two additional questions but this should give you a pretty good idea of what I will ask. See you soon!

Susie

1. For the math liaison activity, you shared aspects of your personal math story. Describe one event, from any point in your life, that stands out in your memory as being especially important or significant with respect to your math story.
2. Looking back at your math story, please identify the single person, group of persons, or organization/institution that has had or have had the greatest positive influence on your perspective of math. Please describe this person, group, or organization and the way in which he, she, it or they have had a positive impact on your story.

3. What will the next chapter of your math story look like? What will you look like as a teacher of math? What will you look like as a learner of math?
4. Please talk to us about the contexts of your school. [Probes]
    a. School demographics (total enrollment, number of sections at each grade level in primary, student characteristics)
    b. School structure (PLCs, grade level meetings)
    c. Peers (other teachers at grade level, primary levels)
    d. Instructional coaches (Does your school have a coach? If so, what types of role does he/she have? How do you work with the coach?)
    e. Administration (What roles do principals/assistant principals/coordinators have?)
    f. School climate (Are teachers here generally supportive of one another? Do teachers regularly observe each other? Plan together? Talk about student issues? Talk about learning goals for students?)
    g. What kinds of professional development for mathematics does your building typically provide?
5. What do you think defines someone as a teacher leader?
6. Tell me about how you view yourself a teacher leader in mathematics.
7. Describe how your view may have changed over the course of this year due to your participation as a K-2 Math Liaison.
8. In what ways do you think others in your building (peers, administrators, etc.) see you as a teacher leader of mathematics?
9. What are some of the activities in which you engage that you think represent your work as a teacher leader of mathematics?
10. How do you identify opportunities for teacher leadership in which to engage? [probe: Do you get approached with leadership opportunities, such as by your principal or district math department?]
11. When you begin a teacher leadership effort, what are some of the things you look at / think about to ensure that the effort is successful?
12. Describe a situation in which your leadership effort in mathematics was most successful.
13. Describe a situation in which your leadership efforts met significant resistance, what happened, and how you responded to this.
14. What are some of the tensions/challenges you experience as a teacher leader of mathematics in your building?
15. What experiences do you feel were most significant in developing you into a teacher leader of mathematics?
16. How would you describe your overall journey as a teacher leader in mathematics?
17. Please talk a little bit about the professional relationships you developed over this year as a result of your participation as a K-2 math liaison.
18. What do you see as the most influential components of the Math Liaison experience in helping you grow as a learner? Teacher? Leader?
19. What do you see yourself doing in the future to contribute to your professional growth and leadership development in mathematics?
20. Is there anything additional you'd like to share regarding your development and work as a teacher leader within your building?

Appendix K: Code Book for Data Analysis

Code Book for Data Analysis

Notes

- When in doubt, double tag.
- In general, tag big chunks including interviewing questions rather than individual turns. However, more than a 1/2 page should be tagged into more than one chunk.
- When there is a shift in focus, even when it is under the same turn, it should be started anew.

Professional Development-Mathematics Content

Refers to both formal and informal, as well as district and building, professional learning that is related to mathematical content. Also includes learning opportunities outside of the district that involves learning about mathematical topics. These opportunities allow for teachers to gain knowledge related to mathematical concepts and ideas.

Professional Development-Mathematics Pedagogy

Refers to both formal and informal, as well as district and building, professional learning that is related to teaching mathematics. Also includes learning opportunities outside of the district that are targeted to improve instruction. Topics related to effective instruction can be such as mathematical discourse, using mathematical tools and representations, productive struggle, mathematical goals/objectives, problem solving, high quality tasks, questioning, assessment, conceptual understanding, and procedural fluency.

Professional Development- Leadership

Refers to professional learning that contributes to improving leadership skills. This could be formal opportunities to study leadership or informal opportunities where teachers gain new knowledge about aspects of leadership through interactions with others such building or district administrators or through leadership experiences.

Teacher Leadership

Roles

Refers to formal roles of teacher leadership, such as serving as a team leader. Also includes informal roles of teacher leadership, such as mentoring, where a teacher exercises leadership. Includes the actions of the teacher in a leadership role and influences on others.

Beliefs

This includes perceptions and beliefs (positive and/or negative) about teacher leadership as well as leadership opportunities presented to a teacher by another person or group.

Opportunities

Includes how others may influence one's teacher leadership as well as how individual seek opportunities for leadership.

Effective Teaching Practices

Refers to aspects of research-informed instructional practices for mathematics in relation to the classroom. This includes beliefs and attitudes about instruction and learning mathematics. Involves topics related to effective instruction such as mathematical discourse, using mathematical tools and representations, productive struggle, mathematical goals/objectives, problem solving, high quality tasks, questioning, assessment, conceptual understanding, and procedural fluency.

Identity

Teacher Identity

Refers to how a teacher views himself or herself in relation to the profession. This may include beliefs or attitudes about how the teacher feels about himself/herself as a teacher. Includes perceptions of how a teacher characterizes oneself as a professional, views themselves in a positive way, as well as how they may view themselves in terms of missing, lacking or needed skills.

Leader Identity

Refers to how a teacher views himself or herself in relation to leadership. This may include beliefs or attitudes about how the teacher feels about themselves as a leader. Includes perceptions of how a teacher characterizes oneself as leader, views themselves in a positive way, as well as how they may view themselves in terms of missing, lacking or needed skills.

Learner Identity

Refers to how a teacher views himself or herself as a learner. This may include beliefs or attitudes about how the teacher feels about himself/herself as a learner. Includes perceptions of how a teacher characterizes oneself as a learner, views themselves in a positive way, as well as how they may view themselves in terms of missing, lacking or needed skills.

Student Achievement

Refers to student learning in mathematics. Also includes beliefs, either positive or negative, about student learning and achievement in mathematics. Involves references to data that may indicate a trend in student learning.

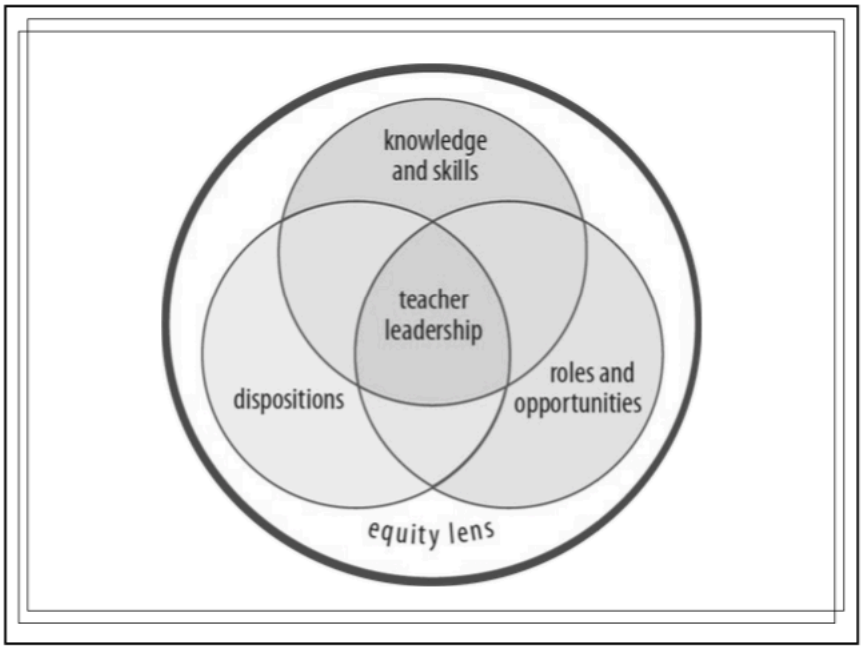
Math Liaison Experience

Refers to the experience of being a math liaison. Also the structure of the liaison meetings, agenda of the meetings, and opportunities in which liaisons may have interacted with other liaisons. Includes lab day experiences and interactions with a liaison facilitator. Both positive and negative aspects of the liaison experience are included.

Appendix L: PowerPoint Slide Presentation from Liaison Meeting #1

Math Stories

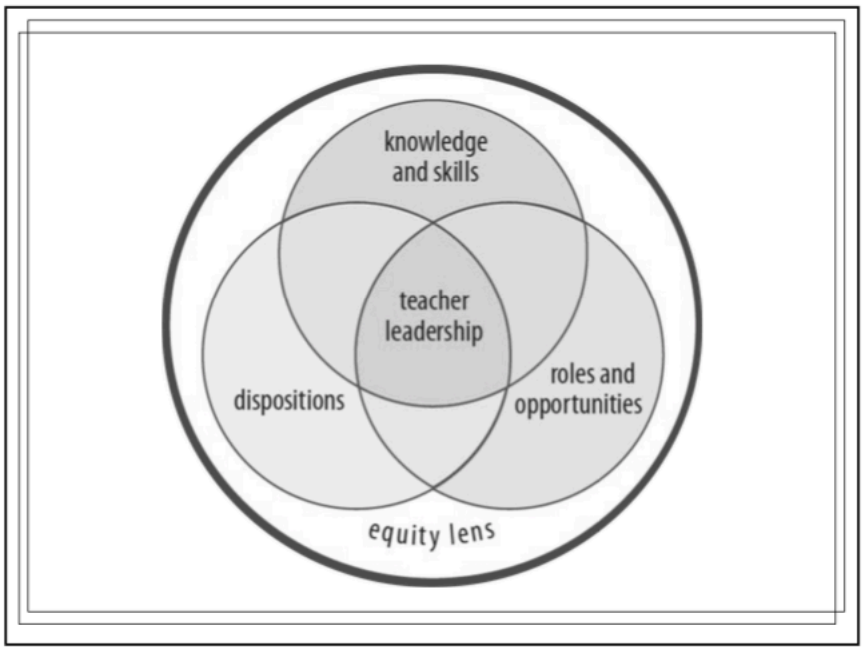
How did what you said and heard about ***learning*** mathematics make you think about ***teaching*** mathematics?



District Expectations for Liaisons

Liaisons receive professional learning opportunities to build capacity in content area as well as their own leadership skills.

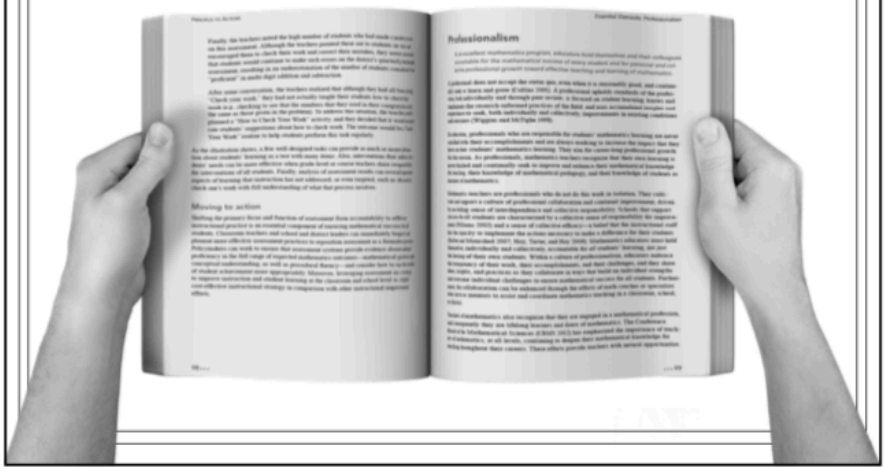
Liaisons will have related professional responsibilities outside of district meeting time (e.g., maintaining building equipment, collecting feedback, preparation for active participation)



Adding to your Professional Library

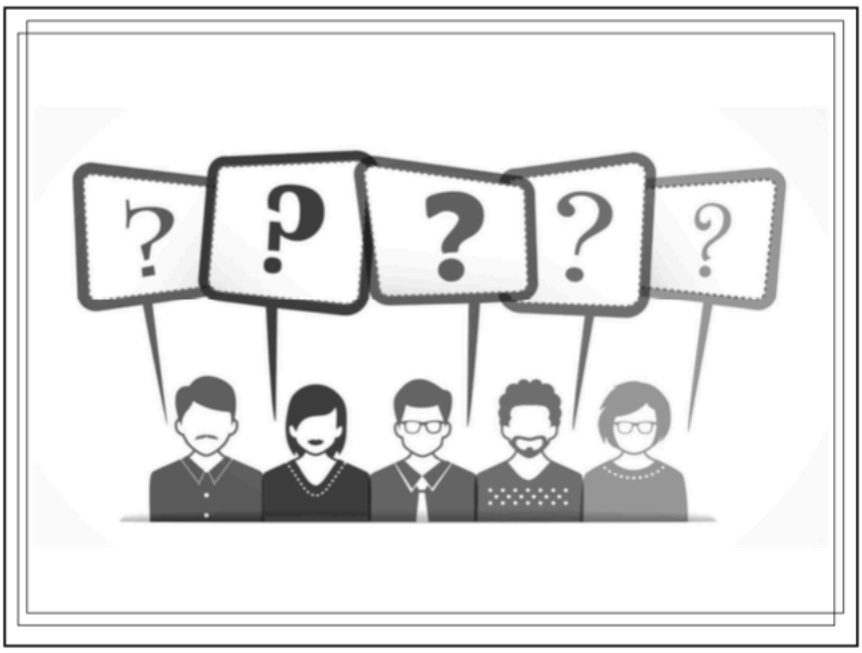
Principles to Actions, pp. 99-106

***stop at "Illustration"**



In round robin fashion, share 1 thing that you highlighted. Don't respond to one another YET!

After Everyone has shared their Highlighted Item Respond to one another and discuss connections.

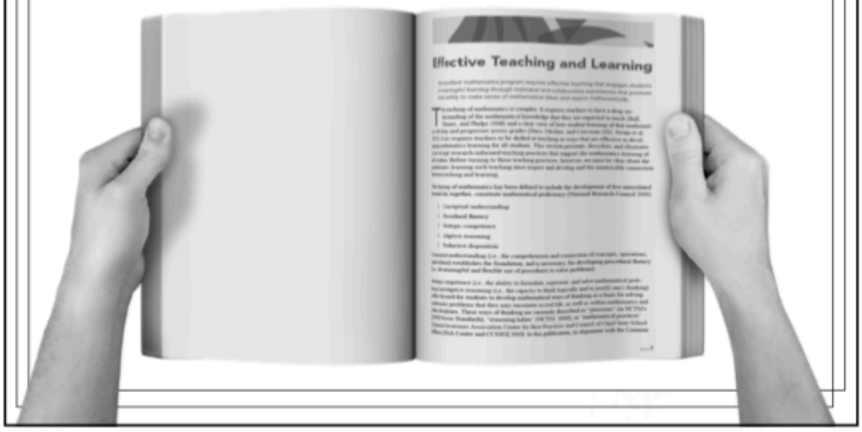


Appendix M: PowerPoint Slide Presentation from Liaison Meeting #2

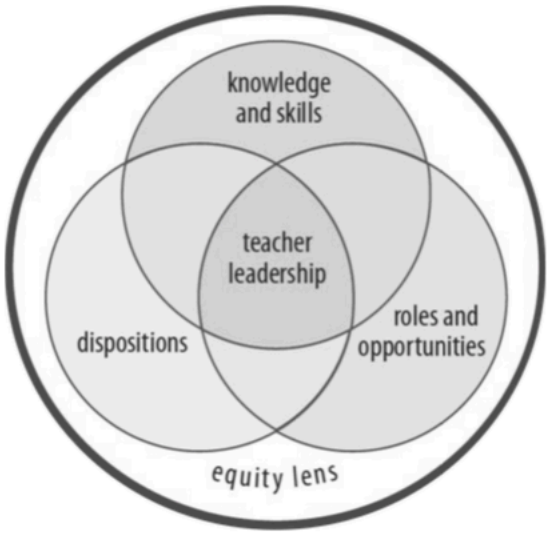
Three men check into a hotel and take a room for $30, with each man paying $10. Later the room clerk notices that the charge for the room should only have been $25, so he gives the bellhop $5 and tells him to return it to the three men. To make the arithmetic easier, the bellhop keeps $2 and gives each of the three men $1 each. Originally, the men had paid $10 each for the room but now that they each got $1 back, each of them paid only $9 for the room. 3 x $9 is $27 plus $2 the bellhop kept is $29. What happened to the other dollar?

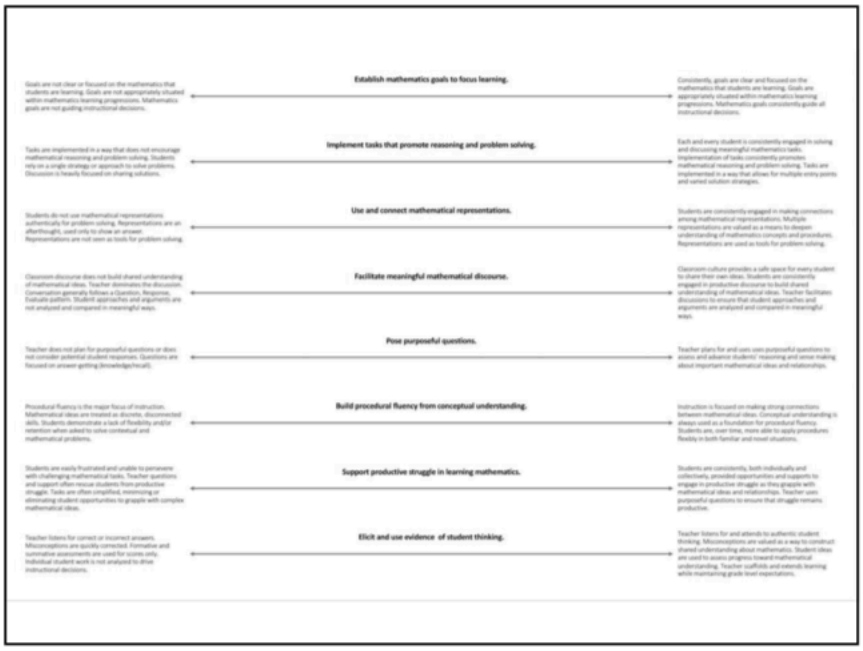
Reading from September

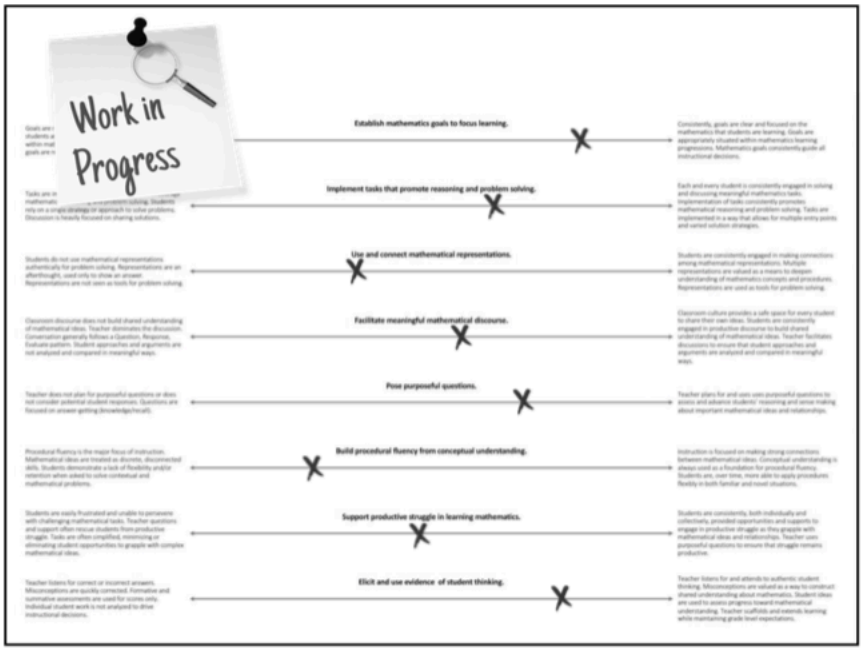
Effective Teaching and Learning
Principles to Actions (pp. 7 - 57)



Mathematics Teaching Practices
Establish mathematics goals to focus learning. Effective teaching of mathematics establishes clear goals for the mathematics that students are learning, situates goals within learning progressions, and uses the goals to guide instructional decisions.
Implement tasks that promote reasoning and problem solving. Effective teaching of mathematics engages students in solving and discussing tasks that promote mathematical reasoning and problem solving and allow multiple entry points and varied solution strategies.
Use and connect mathematical representations. Effective teaching of mathematics engages students in making connections among mathematical representations to deepen understanding of mathematics concepts and procedures and as tools for problem solving.
Facilitate meaningful mathematical discourse. Effective teaching of mathematics facilitates discourse among students to build shared understanding of mathematical ideas by analyzing and comparing student approaches and arguments.
Pose purposeful questions. Effective teaching of mathematics uses purposeful questions to assess and advance students' reasoning and sense making about important mathematical ideas and relationships.
Build procedural fluency from conceptual understanding. Effective teaching of mathematics builds fluency with procedures on a foundation of conceptual understanding so that students, over time, become skillful in using procedures flexibly as they solve contextual and mathematical problems.
Support productive struggle in learning mathematics. Effective teaching of mathematics consistently provides students, individually and collectively, with opportunities and supports to engage in productive struggle as they grapple with mathematical ideas and relationships.
Elicit and use evidence of student thinking. Effective teaching of mathematics uses evidence of student thinking to assess progress toward mathematical understanding and to adjust instruction continually in ways that support and extend learning.




Establish mathematics goals to focus learning.
Implement tasks that promote reasoning and problem solving.
Use and connect mathematical representations.
Facilitate meaningful mathematical discourse.
Pose purposeful questions.
Build procedural fluency from conceptual understanding.
Support productive struggle in learning mathematics.
Elicit and use evidence of student thinking.


Work in Progress
Establish mathematics goals to focus learning.
Implement tasks that promote reasoning and problem solving.
Use and connect mathematical representations.
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Pose purposeful questions.
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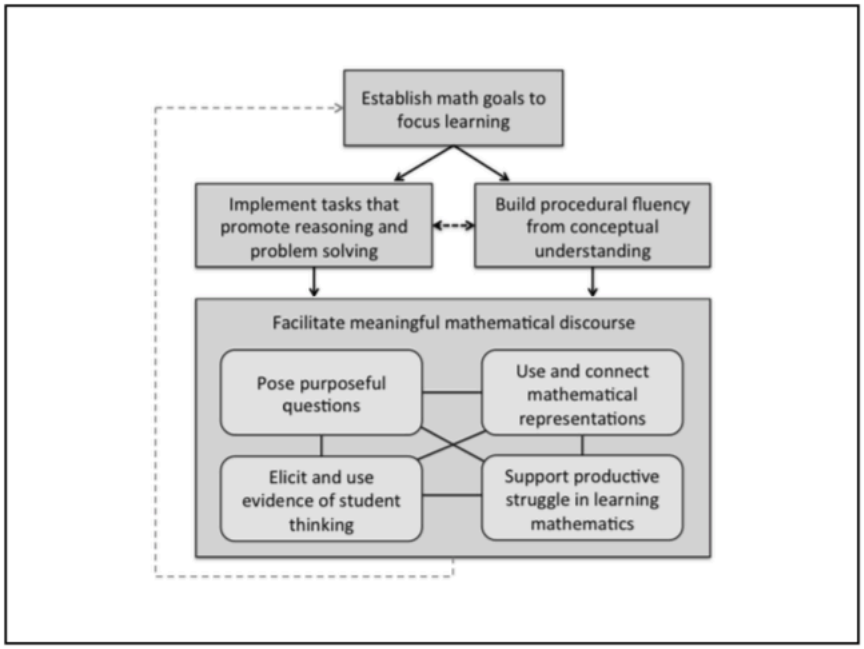
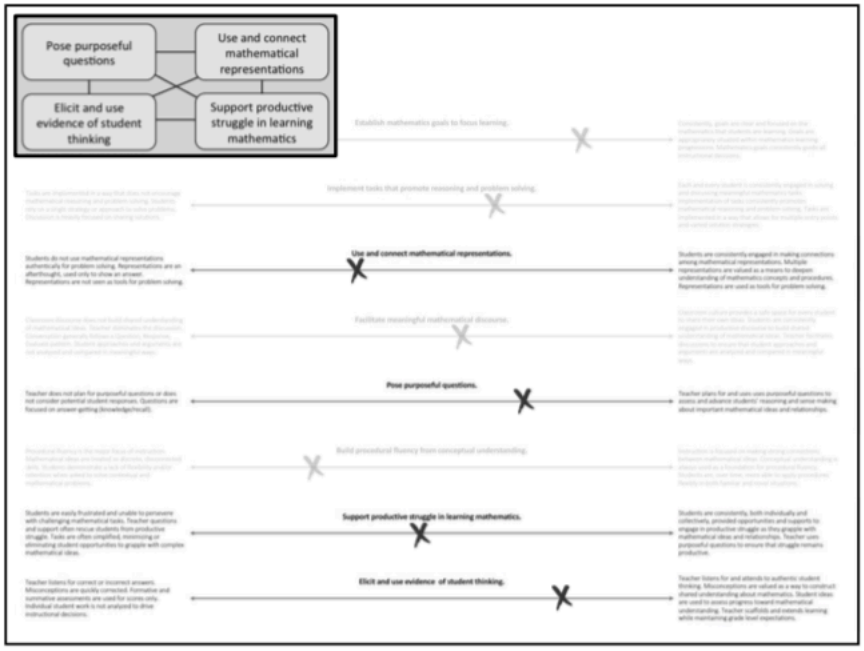
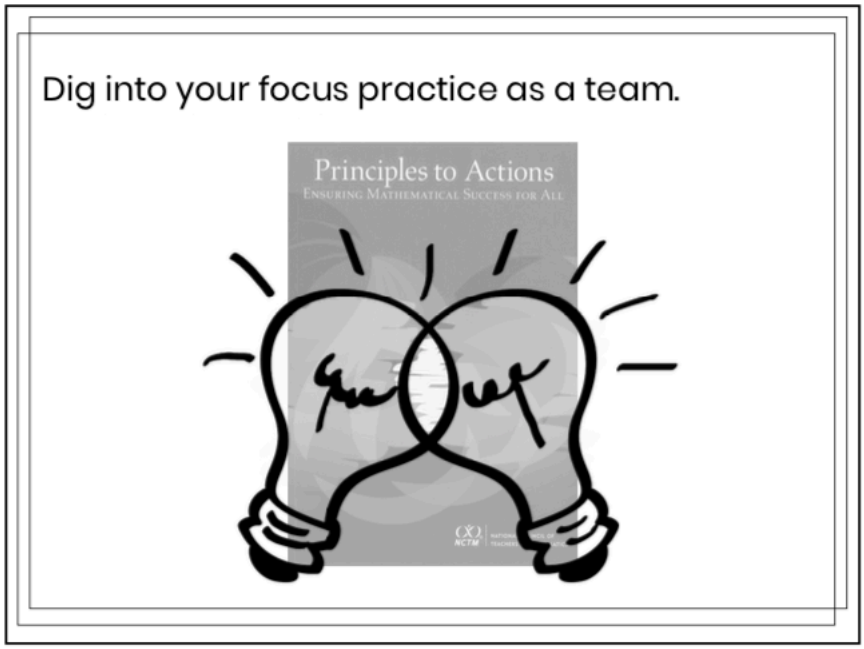
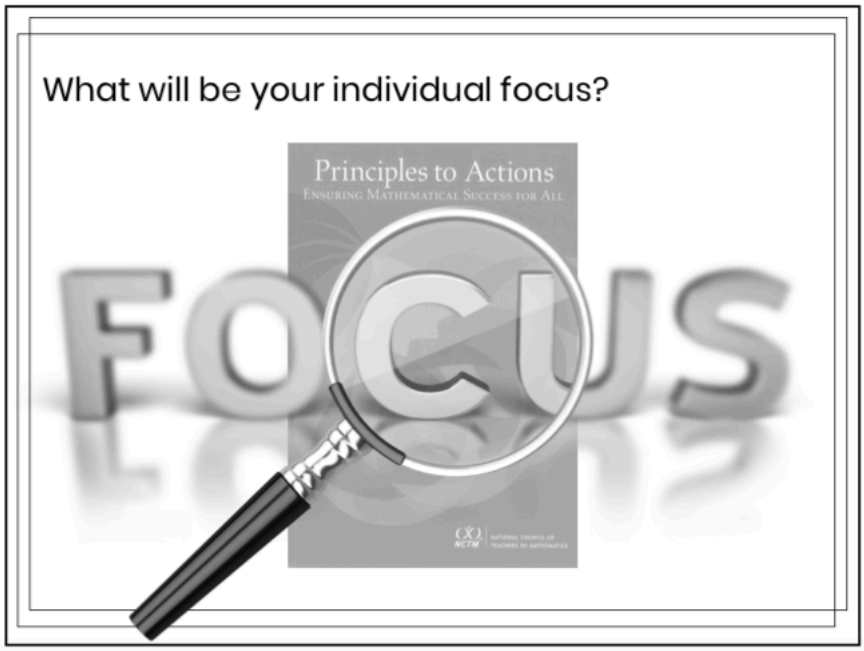
Support productive struggle in learning mathematics.
Elicit and use evidence of student thinking.


Establish math goals to focus learning
Implement tasks that promote reasoning and problem solving
Build procedural fluency from conceptual understanding
Facilitate meaningful mathematical discourse
Pose purposeful questions
Use and connect mathematical representations
Elicit and use evidence of student thinking
Support productive struggle in learning mathematics

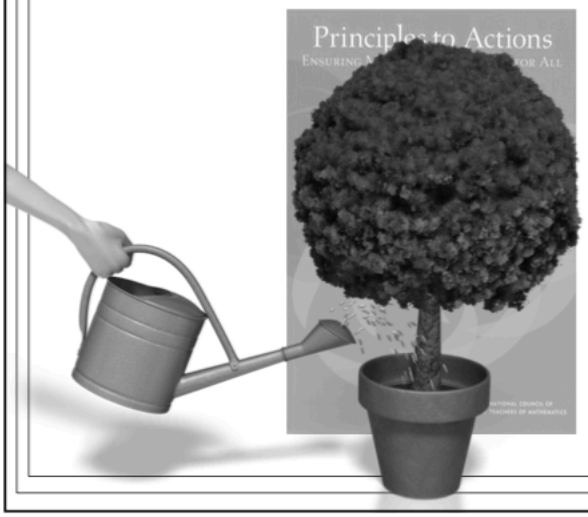

Pose purposeful questions
Use and connect mathematical representations
Elicit and use evidence of student thinking
Support productive struggle in learning mathematics
Use and connect mathematical representations.
Pose purposeful questions.
Support productive struggle in learning mathematics.
Elicit and use evidence of student thinking.


Dig into your focus practice as a team.
Principles to Actions
Ensuring Mathematical Success for All

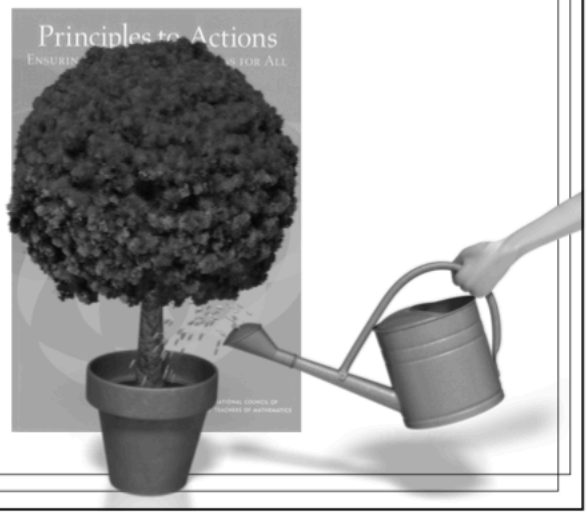

What will be your individual focus?
Principles to Actions
Ensuring Mathematical Success for All
FOCUS

Dig deeper - set two or three concrete goals

How will your “tribe” support you?



How will we support you?



MENU

Effective Teaching Practices

Classroom observation to gather baseline data on a specific teacher action	Classroom observation to gather baseline data on a specific **~~student~~** action	Meet to discuss/analyze a video of a lesson from your classroom to gather baseline data	Conversation before/after school or during plan time to determine a plan

Name:

School: Start time: early late

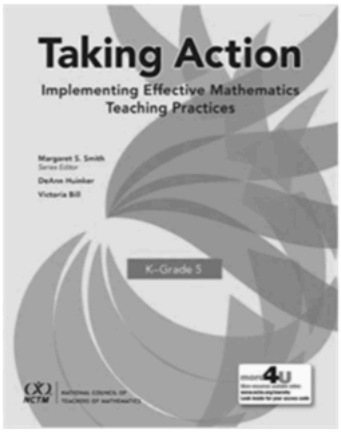
Grade Level:

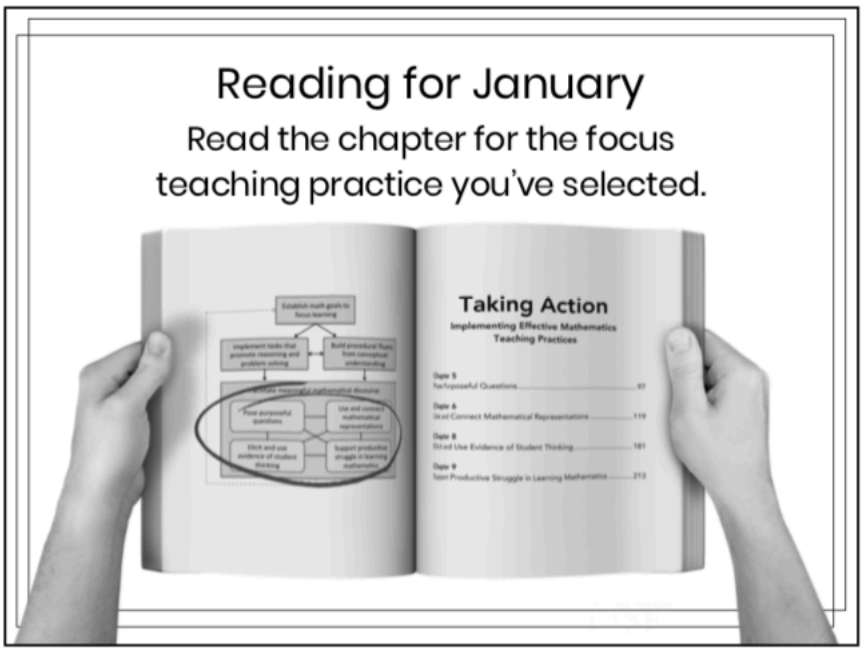
Plan time: Math time:

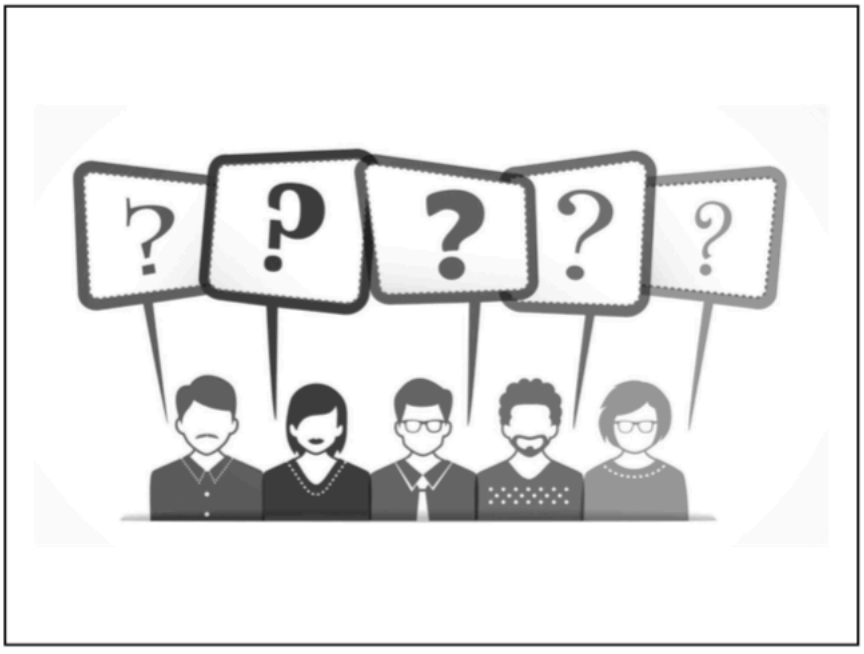
Effective Teaching Practice:

Describe the role you would like Susie to play in your work on this effective teaching practice:

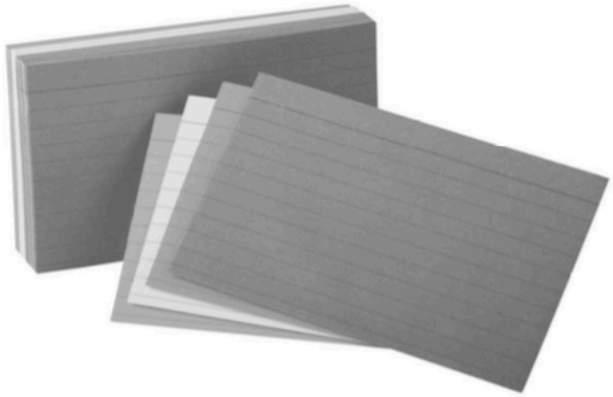
Adding to your Professional Library




Reading for January
Read the chapter for the focus teaching practice you've selected.
Taking Action
Implementing Effective Mathematics Teaching Practices


? ? ? ? ?

Exit Ticket



Appendix N: Continuum of Effective Teaching Practices

Appendix O: Menu of Support for Effective Teaching Practices

MENU

Effective Teaching Practices

Classroom observation to gather baseline data on a specific ***teacher*** action	Classroom observation to gather baseline data on a specific ***student*** action	Meet to discuss/analyze a video of a lesson from your classroom to gather baseline data	Conversation before/after school or during plan time to determine a plan

Appendix P: Support Request Form

Name:

School: Start time: early late

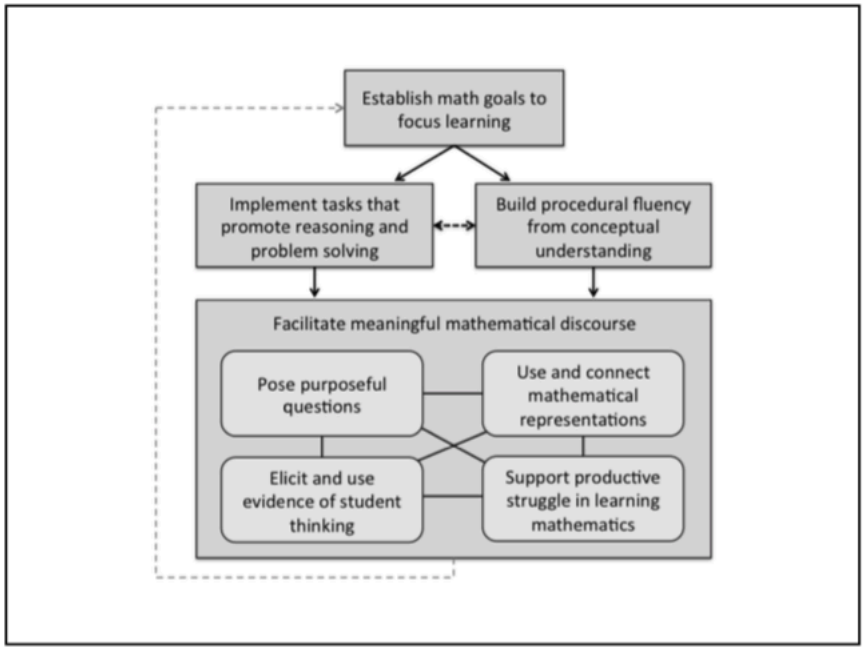
Grade Level:

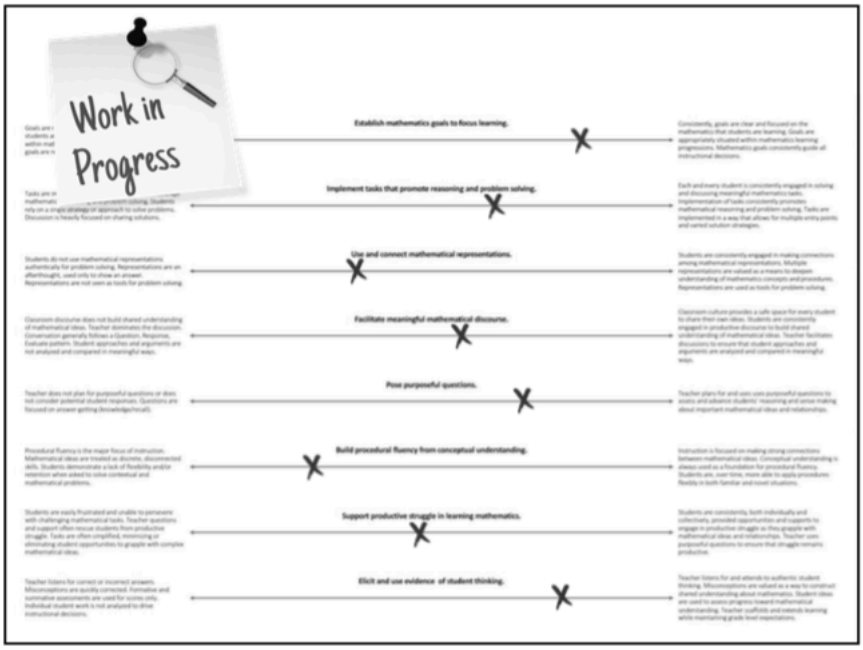
Plan time: Math time:

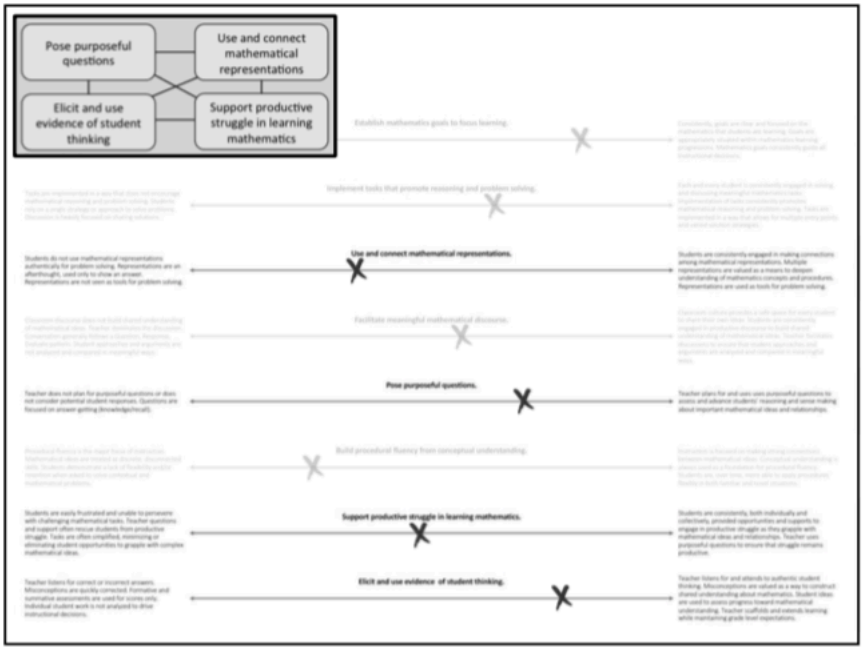
Effective Teaching Practice:

Describe the role you would like Susie to play in your work on this effective teaching practice:

Appendix Q: PowerPoint Slide Presentation from Liaison Meeting #3



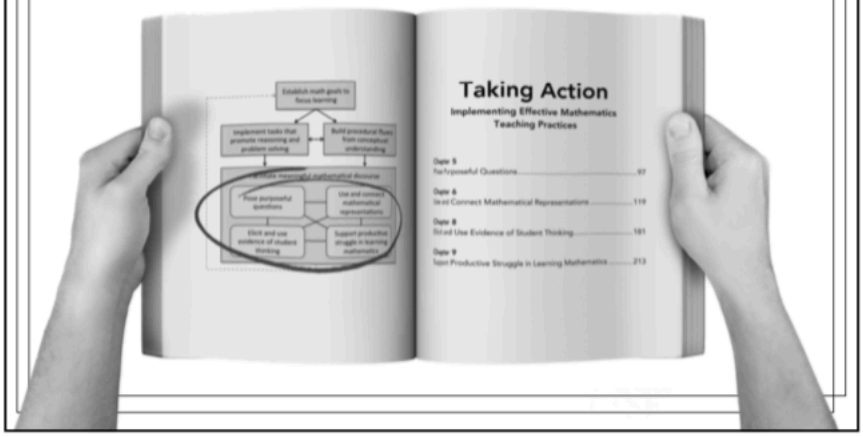

Work in Progress
Establish mathematics goals to focus learning.
Implement tasks that promote reasoning and problem solving.
Use and connect mathematical representations.
Facilitate meaningful mathematical discourse.
Pose purposeful questions.
Build procedural fluency from conceptual understanding.
Support productive struggle in learning mathematics.
Elicit and use evidence of student thinking.


Pose purposeful questions
Use and connect mathematical representations
Elicit and use evidence of student thinking
Support productive struggle in learning mathematics
Use and connect mathematical representations.
Pose purposeful questions.
Support productive struggle in learning mathematics.
Elicit and use evidence of student thinking.

Reading from November

focus teaching practice

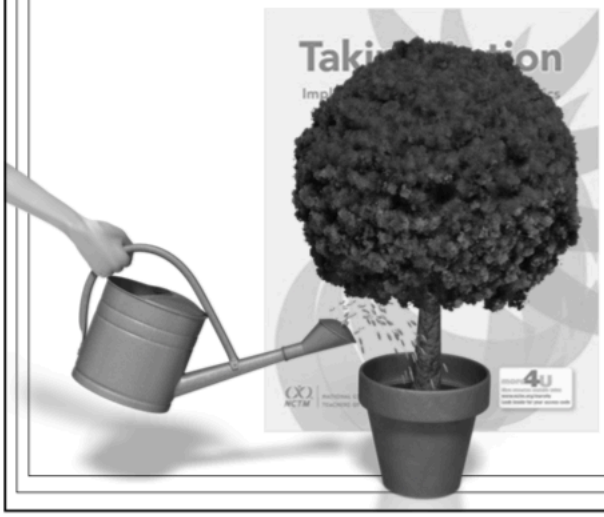
Taking Action

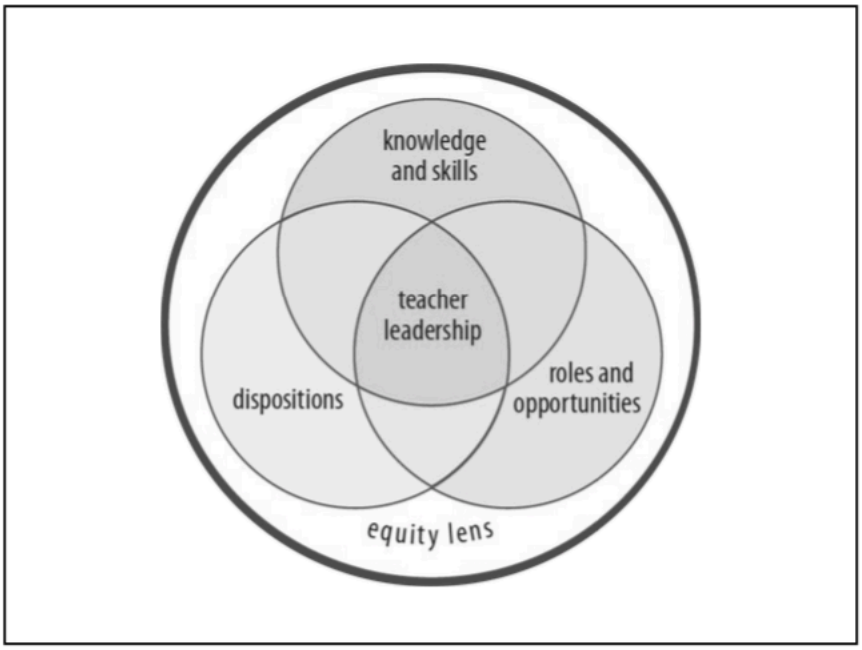


Revisit your focus practice as a team.

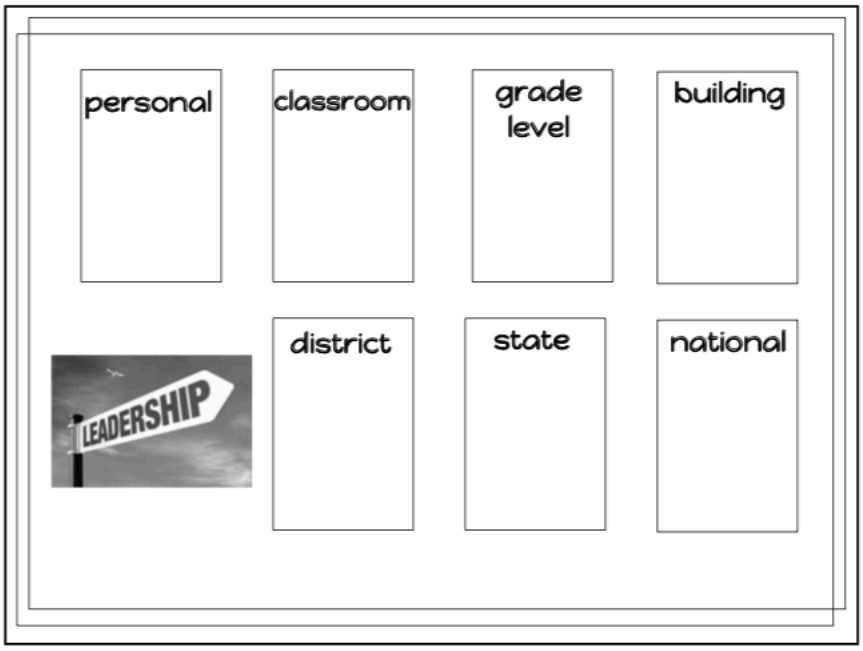
Share progress toward the goals you set.

What are your next steps?
How will this community continue to support you?

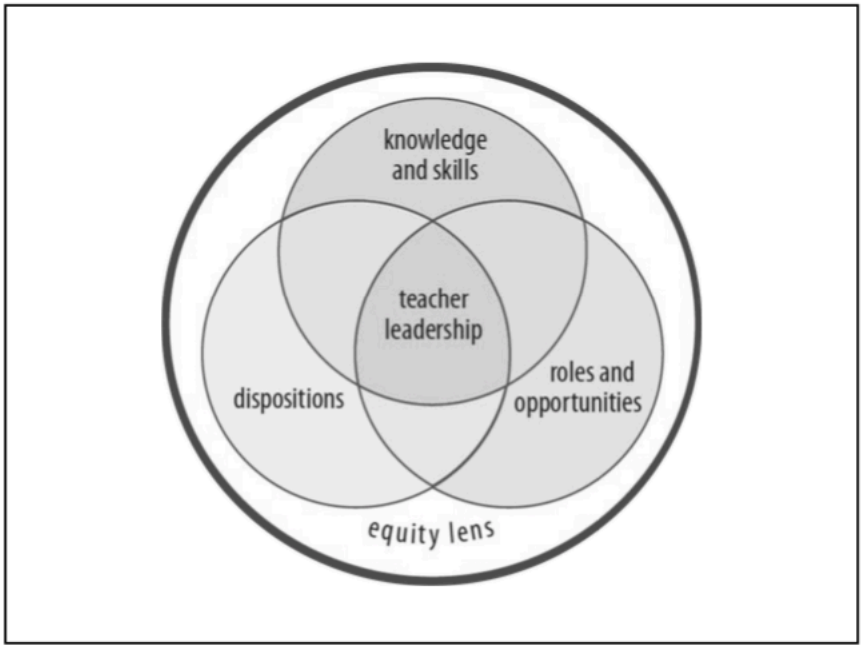



knowledge and skills
teacher leadership
dispositions
roles and opportunities
equity lens


Leadership…..
so, what is this?


personal
classroom
grade level
building
district
state
national
LEADERSHIP


Personal goal for leadership growth
MY GOALS
1.
2.
3.



Lab & Learning Day

A wonderful opportunity!!

Different options:

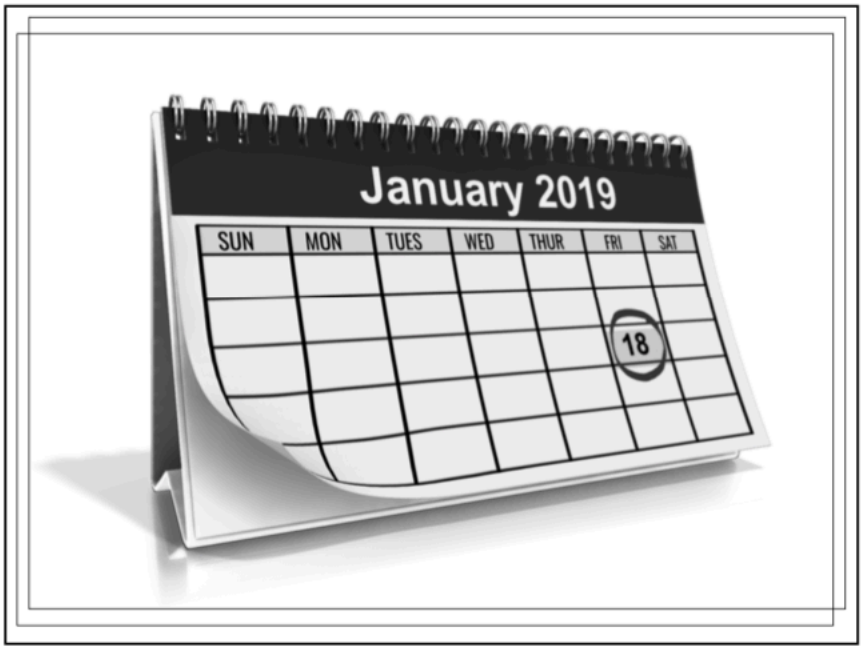
½ Day

p.m. : diving deeper into equity in mathematics

Full Day

a.m. : bring video of an activity to share/discuss

p.m. : diving deeper into equity in mathematics



Next Meeting: March 20th

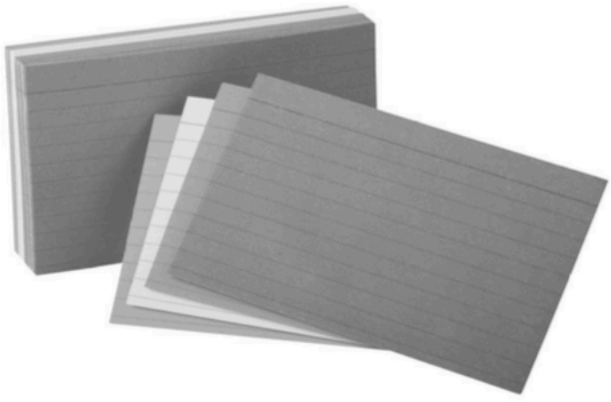
Think about and be prepared to discuss:

1. Your learning journey over the past six months
2. Ideas for how this group might connect with new liaisons during the 2019-2020 school year
3. Your perceptions regarding the liaison experience

AND

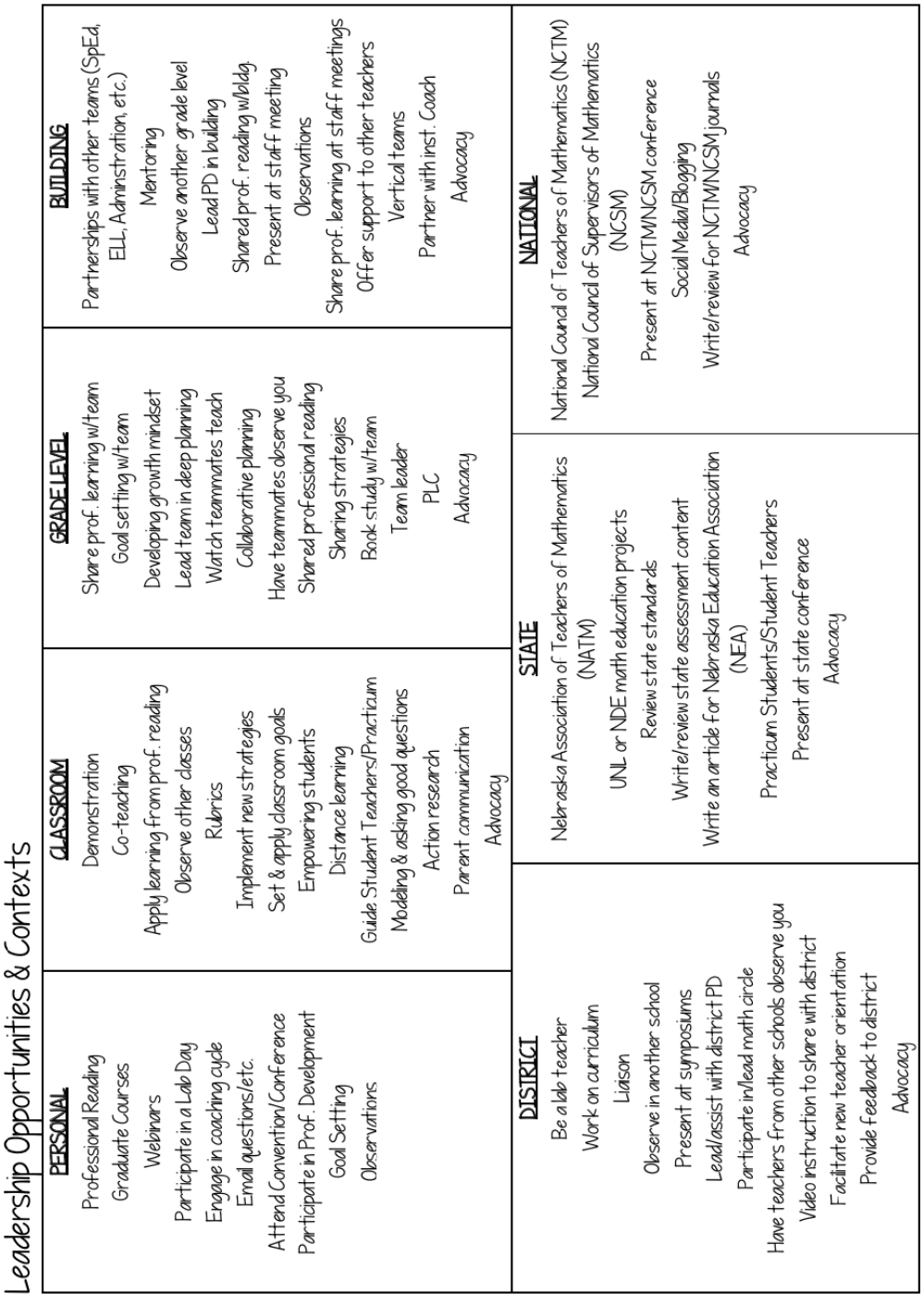
Dedicate time and thought to your effective math instruction and leadership goals

Exit Ticket




"Faith is taking the first step even when you don't see the whole staircase."
-Martin Luther King, Jr.

Appendix R: Opportunities for Leadership in Mathematics



Appendix S: Reflection Google Form

Reflecting on your experience as a Mathematics Liaison

Your email address will be recorded when you submit this form. Not you?
Switch account

* Required

First Name *

Your answer

Last Name *

Your answer

Building *

Choose

You selected a specific mathematics teaching practice and set a goal to shift your practice in that area. Discuss your progress toward that goal. What, if anything, about the work we did in liaisons this year supported that work? *

Your answer

Do you feel that your work on your focus practice resulted in shifts in any of the other practices on the page? Please explain. *

Your answer

Do you feel that your work as a liaison this year contributed to opportunities for leadership in your building? Please explain. *

Your answer

Before our first meeting, you wrote about your personal math story. What would you add to that story as a result of your work as a liaison this year? *

Your answer

A copy of your responses will be emailed to

SUBMIT

Never submit passwords through Google Forms.

Appendix T: Lab Day Agenda

Lab Day Agenda

AM

8:15 a.m. Welcome and Overview of Day

8:30 a.m. Effective Teaching Practices
- -Touch base with Teaching Practices group and talk about key ideas
- -As a group, create an "elevator speech" about your effective teaching practice

8:45 a.m. Whole Group Round Table
- -Share elevator speeches
- -Discuss key ideas and make connections

9:15 a.m. Donut Task
- -Review Teacher/Student Action Tables in *Principles to Actions*
- -Discuss Video Observation Protocol
- -Watch Clips 1 & 2 of The Donut Task (NCTM PtA Tool Kit)
  - *Watch each clip twice. First observe. Second time look for evidence of teaching strategy

10:15 a.m. Break

10:30 a.m. Peer Video Observation
- -Use Video Observation Protocol
- -Set personal goal based on feedback and conversation

11:30 a.m. Reflection on Morning

11:45 a.m. Break for Lunch

PM

1:00 p.m. Welcome back and Overview of Afternoon

1:15 p.m. Equity Visualization Activity

1:30 p.m. *What is Equity?* Graph
- -Participants take time to record their thoughts of equity on Post-it notes
- -Collectively, group puts Post-it notes in big ideas or categories

-Follow-up conversation

2:00 p.m. Read from *Principles to Actions*
-Participants read pages 59-69
-Whole group conversation
-Look at table on p. 63
-Discuss

2:30 p.m. Equitable Classroom Posters
-In small groups, participants crate poster with description of an ideal, equitable classroom (include non-negotiables)

3:00 p.m. Revisit Equity Graph and Discuss Implications

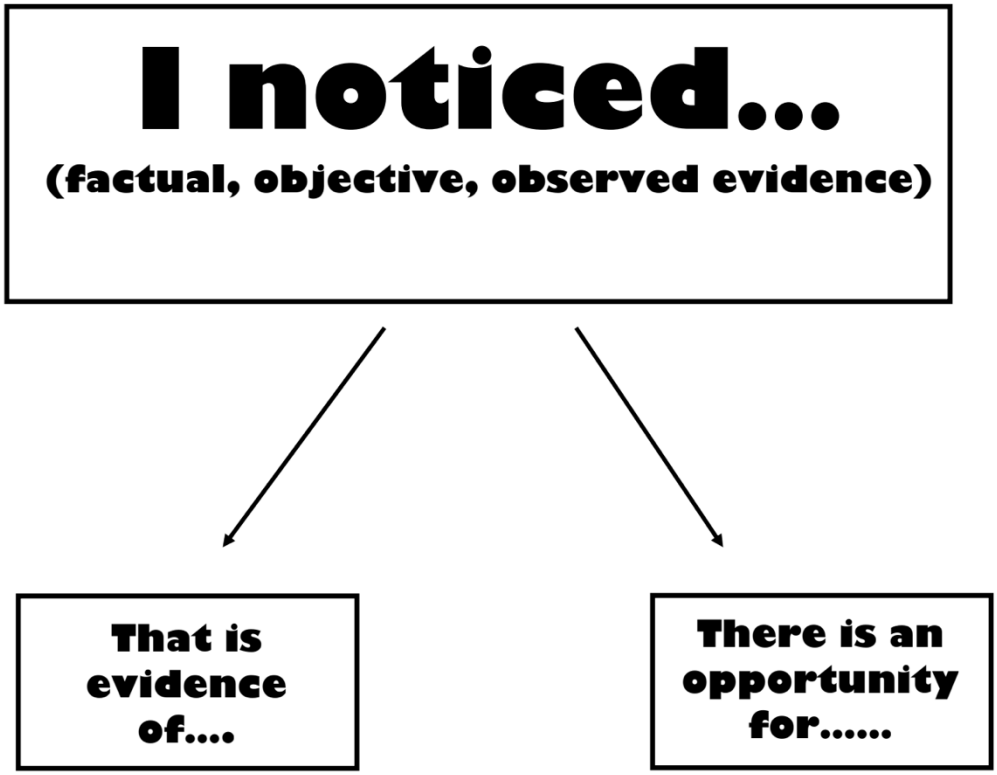
3:15 p.m. Read *Taking Action*
-Participants read pp. 259-262
-Whole group discussion

3:45 p.m. Call to Action

-Set individual goals for own practice in terms of equity and access

3:55 p.m. Wrap-up Day & Dismiss
-Provide Chapter 9: Providing Access to Equitable Mathematics Learning as follow-up reading

Appendix U: Video Observation Protocol



Appendix V: Equity Visualization Activity

Equity Visualization Activity

It will be your job to try to create a visual image of this school as I offer information I would like you to think about:

Think about an elementary school in inner-city Detroit, Michigan.

1. What does the building look like?
    a. What is it made of?
    b. How old do you perceive it to be?
    c. How many stories does this building have?
2. What is the ethnicity of this building?
3. How might you describe the parent involvement of this school?
4. How do the student behave?

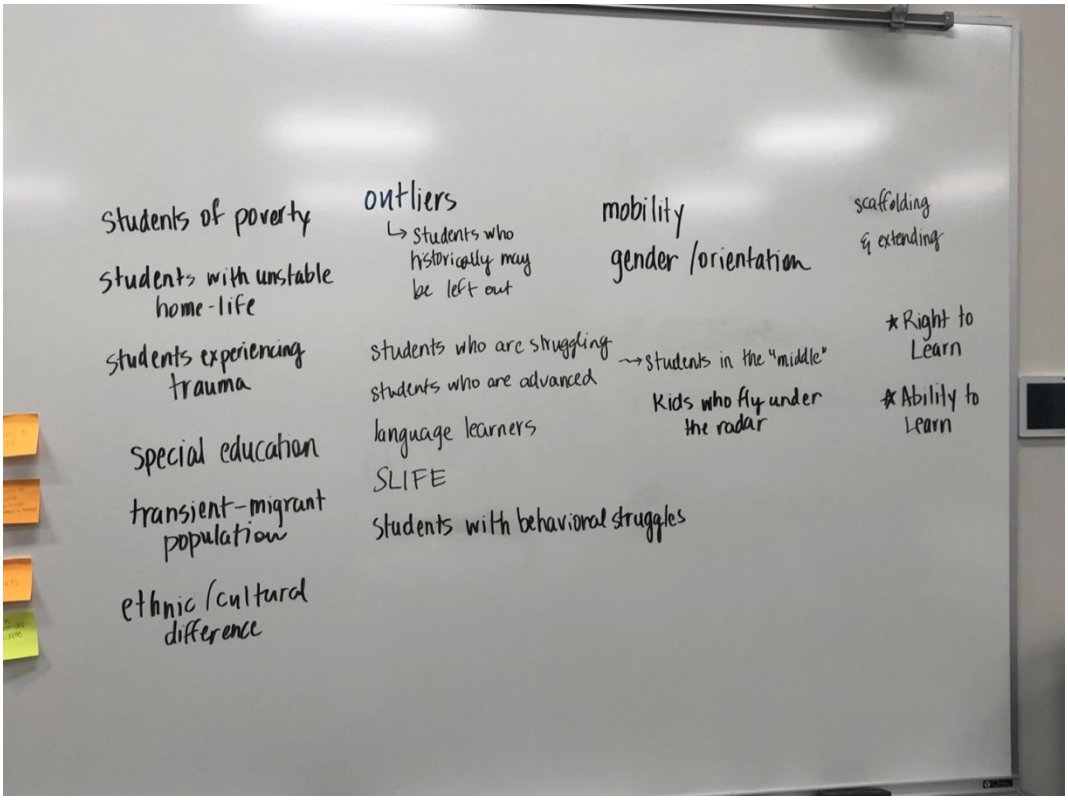
Who would like to describe the image you created in your mind?

Reality:

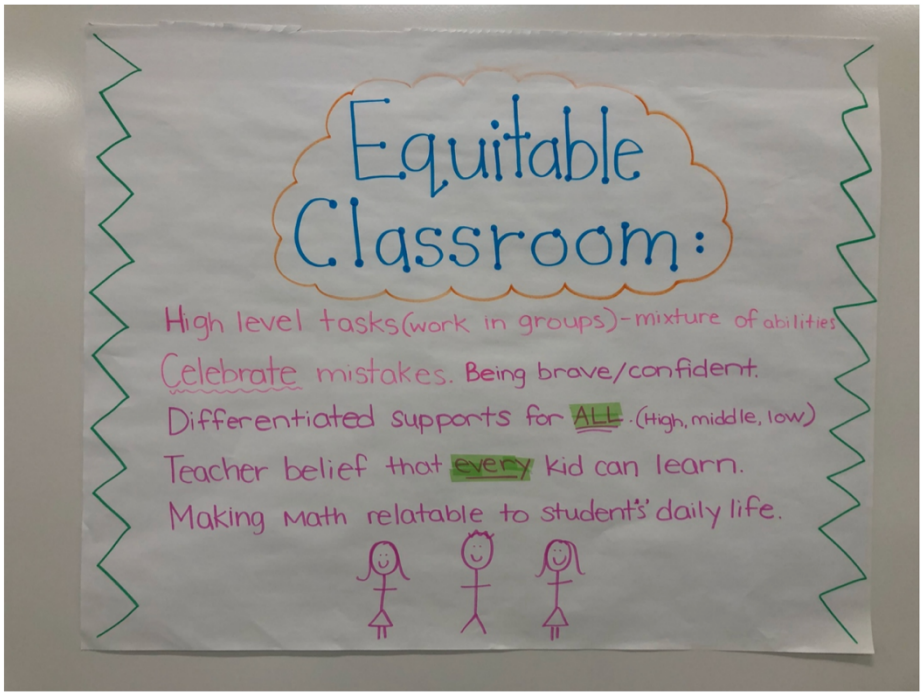
1. The building is newer brick, built in 1971. It is one-story high.
2. Over 90% students of color.
3. Parent involvement is high—very engaged and interested in their child's education.
4. Behavior is not an issue. Arguments happen but no physical altercations.

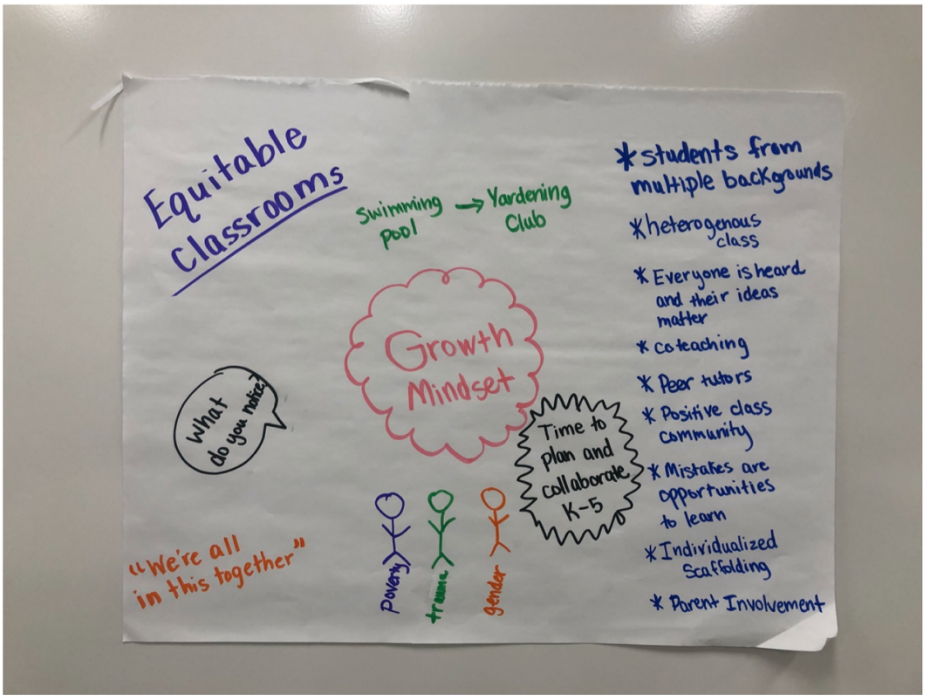
Reflection Questions:
Did your initial image match this building's reality?
Why or why not?
What does this have to do with equity?

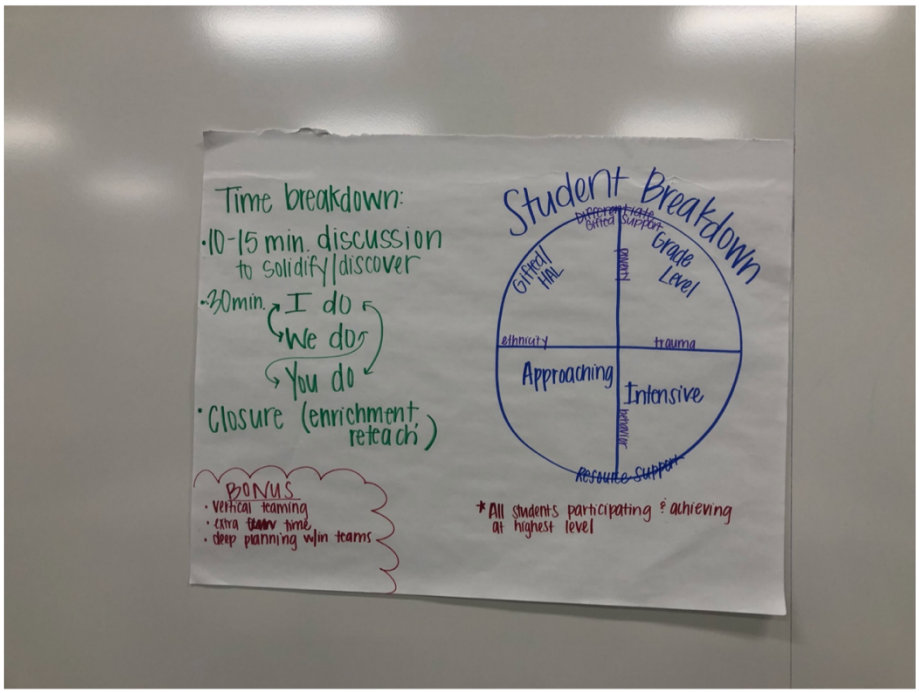
Appendix W: Picture of Equity Graph

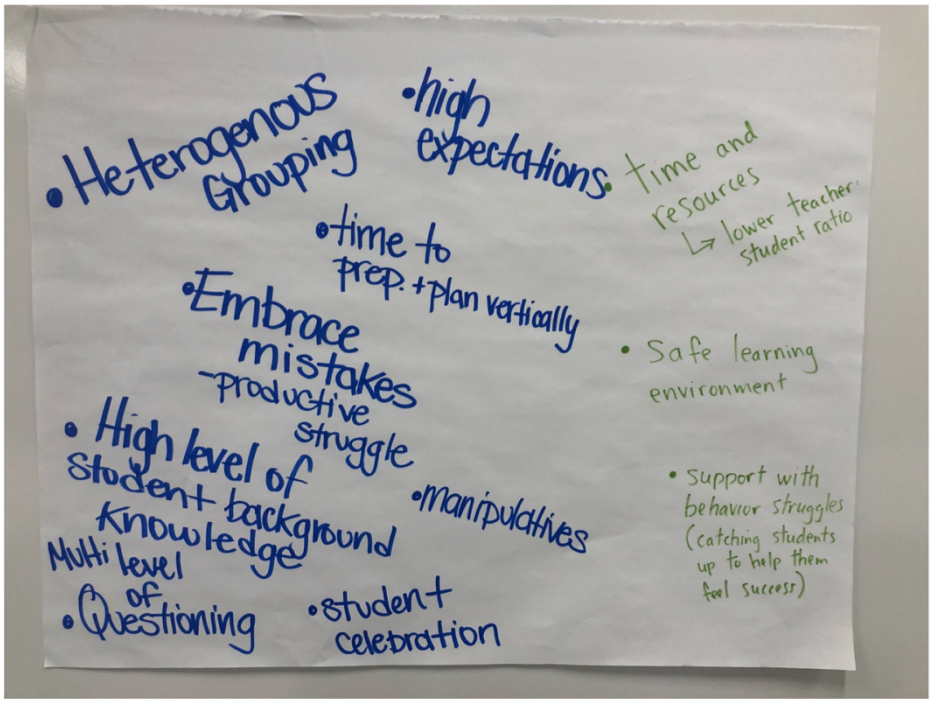


Appendix X: Photographs of Equitable Classroom Posters






Time breakdown:
•10-15 min. discussion to solidify/discover
•30min. I do
We do
You do
•Closure (enrichment reteach)
BONUS
• vertical teaming
• extra team time
• deep planning w/in teams
Student Breakdown
Gifted/TAL
Grade Level
ethnicity
trauma
Approaching
Intensive
Resource Support
*All students participating & achieving at highest level


• Heterogenous Grouping
• high expectations
• time to prep. + plan vertically
• Embrace mistakes
-productive struggle
• High level of student background knowledge
• manipulatives
Multi level of
• Questioning
• student celebration
• Time and resources
↳ lower teacher: student ratio
• Safe learning environment
• support with behavior struggles (catching students up to help them feel success)