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May, 2011

KNOWLEDGE AND CHARACTERISTICS OF EMERGING MATHEMATICS  
TEACHER LEADERS: BECOMING A SCHOOL-BASED MIDDLE SCHOOL  
TEACHER LEADER

A Dissertation Presented to the  
Faculty of the College of Education  
University of Houston

In Partial Fulfillment  
of the Requirements for the Degree

Doctor of Education

by

Maryann Siegmyer

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To: Faculty  
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SUBJECT: DISSERTATION ABSTRACT

Faculty members may request a complete copy of the dissertation from Dr. Jennifer Chauvot, Room 409 Farish Hall. Please direct your comments regarding this abstract to Dr. Jennifer Chauvot no later than April 28, 2011.

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## Abstract

Mathematics teacher leaders and their capacity to facilitate significant change within secondary mathematics classrooms on a campus, or throughout a series of campuses within a school district, is affected by mathematics, pedagogical content, curricular, and contextual knowledge. It is also influenced by teacher leadership characteristics that support clear communication, reflective practices, and the building and maintenance of collegial relationships with peers. Deep understanding of instructional content, of effective practices that foster improved student achievement, and of the coaching process and its practices aids their work with peer teachers.

The study's purpose was to describe perceptions about leadership characteristics held by novice mathematics teacher leaders participating in a middle school master mathematics teacher program. Coursework in the program focused on content and pedagogical content understanding involving number concepts, algebraic thinking, and probability and statistics, as well as developing an understanding of what it means to be a teacher leader. The study participants were candidates from a 17-member cohort in a major urban southwestern university's 24-month master middle school mathematics teachers program, a collaboration between the departments of curriculum and instruction and mathematics at the university to provide graduate courses and associated embedded practicum-hours for this certification program.

Qualitative methodologies were used to infer what characteristics and dispositions do emerging middle school mathematics teacher leaders perceive as important to their work with peer teachers in a school-based learning situation, and the alignment of these perceptions with state and national standards for mathematics educational leaders. The primary record was constructed by the researcher, a non-participant evaluator of the project, from the participants' responses and reflections during individual face-to-face interviews.

The study found that characteristics that all of the participants valued for their future work as school-based teacher leaders were approachable, collaborative, and reflective. Aspects of these three attributes were cited by all, but several also commented about their understanding and valuation of equitable, credible, competent, assessment-focused, and research-focused. These perceptions of characteristics important to their future work were in alignment with several of the characteristics prominent in the state's recommendations regarding the work of mathematics teacher leaders. The participants indicated that other characteristics might develop or be of more value later in their careers. Their understanding of the principles and the action indicators of national standards for mathematics teacher leaders was not as clear. The analysis also revealed that frequent informal and formal mentoring, observations on their campuses and within the district, and time to reflect and collaborate on their practice provided opportunities for nascent mathematics teacher leaders to develop and understand the leadership characteristics they need to effectively and efficiently provide support for mathematics reform efforts.



The study provides information of potential value about the development of emerging mathematics teacher leaders to state and national agencies and researchers, to professional development providers, to universities working with pre-service and in-service mathematics teachers, and to individual campuses and school districts.

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## **CHAPTER ONE**

### **INTRODUCTION**

Teaching shapes students' understanding of mathematics, their affective response to mathematics, and their ability to use mathematics to solve problems (National Council of Teachers of Mathematics (NCTM), 2000). Expectations about the quality of mathematics teaching are rising amid calls to prompt reform in instruction that dramatically improves learning by all students. Teachers are challenged to present difficult curricula to diverse learners, use analytical data to inform instruction, collaborate, build, and influence learning communities, and assume leadership roles that encourage school improvement.

Effective professional development for pre- and in-service teachers should facilitate teacher learning opportunities that support these reform efforts. Teachers need to gain insight into underlying mathematical principles and concepts and the interconnections of topics, and how best to differentiate instruction for increasingly heterogeneous classrooms. They also need to know how to effectively analyze and use formative and summative assessment data. Modeling of collaboration and of individual reflection on practice, and instruction leading to an understanding of local, state, and national initiatives in mathematics would be helpful to future school-based teacher leaders. This teacher learning can be provided by professional development grounded in sound theories about learning and adult learning, centered on teacher thinking, and situated in a context that encourages its use and evaluation by the teacher in his own classroom. The thrust of mathematics professional development is shifting from one with a traditional stance of workshops and presentations to one using extended, job-embedded

learning. Such contextual school-based professional development provides an opportunity for teachers to quickly implement in their classrooms what they have learned, evaluate instructional changes, and reflect upon the effectiveness of the newly-learned strategies individually and with their peers.

The charge to prompt reform in mathematics classrooms must identify and support teacher leaders working with their peers on their respective campus(es) to provide these contextual learning opportunities. Often school-based staff development is provided by teacher coaches, mentors, or content specialists who continue as teachers on the campus while working with other teachers during release time. Frequently their roles are ill-defined with little campus or outside direction, support, and resources.

### **Need for the Study**

Learning to teach is a career-long, generative endeavor requiring frequent feedback and time to plan and confer with peers about mathematics instruction. Administrators on campuses and within school districts often lack the time, money, attention, and understanding of the teacher leadership requirements to provide mathematics instructors on-going, sustained, and immediate support and guidance. Developing mathematics teacher leaders who positively influence their peers' practice is critical to implementation of higher standards of professional excellence for these teachers. School-based teacher leaders can provide appropriate, sustained, and immediate support and guidance where their expertise can be best implemented. Since content knowledge and content pedagogical knowledge are important to teachers being able to implement reform within their classrooms (Adler, Ball, Krainer, Lin, & Novotna, 2005; Ball, Thames, & Phelps, 2008; Borko et al., 1992; Eisenhart et al., 1993), this

researcher and others (Hiebert & Morris, 2009; Reeves, 2008, 2010; Richard, 2004) propose that such knowledge is even more critical for those, like these school-based teacher leaders, who provide campus embedded staff development for mathematics teachers to initiate classroom reform. There is scant research on how emerging mathematics teacher leaders develop the necessary additional skills and characteristics to successfully navigate the structures of schools and districts, build collegial relationships, encourage collaboration by curriculum teams, and foster educational improvement at the level of classroom instruction. Little is known about how best to prepare teacher leaders for their work with peer teachers on their campuses. However, research about teachers and their knowledge development provides a basis for investigation of these mathematics teacher leaders.

This research involved emerging teacher leaders participating in the early phases of a state-approved master middle school mathematics teacher program. It studied the perceptions of these emerging teacher leaders about the characteristics and dispositions of mathematics teacher leaders during their own coaching and mentoring experiences. Findings from this study can serve as a starting point for how to best support teacher leaders as they move into their new roles.

### **Statement of the Problem**

Teachers use content knowledge and beliefs about content, teaching, and learning to filter their construction of new knowledge (Mewborn, 2003; Philipp, 2007).

Conditions that support the development of new teacher knowledge are opportunities to revisit the content taught to gain insights into interconnections among topics, professional development linked to practice, collaborative peer support, and time and opportunities to

individually reflect on one's practice (Reeves, 2009). This researcher proposed that these conditions, and others, are also needed for mathematics teacher educators to develop leadership skills and the content and pedagogical knowledge necessary to work effectively and collaboratively with peers during school-based professional learning. Little research has been done on growth of leadership skills of emerging mathematics teacher leaders and any changes in attitudes and beliefs that may affect their work with peer teachers.

### **Purpose of the Study**

The purpose of the study is to describe perceptions about leadership characteristics held by novice mathematics teacher leaders participating in a middle school master mathematics teacher program. The primary focus of the research was on the emerging teacher educators' descriptions of the construct of teacher leadership and its characteristics and dispositions as they prepared for work with peer teachers on their campuses or within their school districts. A second focus of this research was to understand the teachers' perceptions of the construct of teacher leadership in terms of state and national standards for teacher leaders.

### **Significance of the Study**

Consideration of the perceptions as they may influence the future work of these emerging middle school teacher leaders may clarify how to support teachers and nascent teacher leaders as they begin their work with peer teachers in school-based situations. Those characteristics thought important by state and national policymakers to the work of mathematics teacher leaders at various levels are identified in this research. An investigation of the alignment of these characteristics and dispositions to those perceived



important by the participants may reveal areas that need further development by districts, universities, and states agencies working with mathematics teachers preparing for roles as campus leaders.

### **Research Questions**

Because the study's purpose is to describe the perceptions and understandings of the characteristics and dispositions of emerging teacher leaders participating in a middle school mathematics master teacher program, the research addressed the following research questions:

Research Question One. What characteristics and dispositions do emerging middle school mathematics teacher leaders perceive as important to their work with peer teachers in a school-based learning situation?

Research Question Two. Based on these perceptions, how do the teachers interpret the State of Texas Master Mathematics Teacher Standards?

Research Question Three. Based on these perceptions, how do the teachers understand the principles and indicators for mathematics educational leaders contained in the PRIME Leadership Framework of the National Council of Supervisors of Mathematics?

### **Definitions of Terms**

Several terms are defined for the purpose of this study.

**Emerging teacher leaders.** The term “emerging teacher leaders” is defined as teachers preparing for instructional leadership positions on their campuses or within their school district.

**Master Mathematics Teacher.** The term “Master Mathematics Teacher” refers to individuals who hold Texas’ Master Mathematics Teacher Certificates and whose primary duties are to teach mathematics and serve as instructional mentors to fellow teachers on an identified high-need campus. To earn a Master Mathematics Teacher Certificate, teachers must hold a teaching certificate, have at least three years of teaching experience, complete a Master Mathematics Teacher preparation program approved by the Texas State Board for Educator Certification, and pass the master mathematics teacher certification examination for the appropriate grade level (Early Childhood through Grade 4; Grades 4-8; or Grades 8-12).

**Master Mathematics Teacher standards.** The term “Master Mathematics Teacher standards” are standards developed by Texas educators and other education stakeholders that articulate the critical knowledge and skills an initially certified Master Mathematics Teacher needs to instruct successfully. They incorporate the Texas Essential Knowledge and Skills (TEKS) student expectations as the focal point, but also include standards related to instruction, a positive learning environment, and assessment.

**Number concepts.** The term “number concepts” is defined as the knowledge of numbers, number systems, and their structure, operations and algorithms, and the knowledge of quantitative reasoning.

**Algebraic thinking.** “Algebraic thinking” is defined as the use of mathematical reasoning and mathematical thinking tools to identify, extend, and analyze patterns, particularly in relationships involving variables, expressions, equations, inequalities, relations, and functions.

**Probability.** The term “probability” includes those skills and understanding needed to use the concepts and principles of probability to describe the outcomes that result from the generation, simulation, and use of probability models, and to recognize misuses of probability.

**Statistics.** The term “statistics” refers to an understanding of the use of appropriate graphical displays and descriptive statistics for data and to the investigation of real-world problems by designing, administering, analyzing, and interpreting statistical experiments and data from surveys. It also refers to an understanding of how data is collected and represented.

**Geometry.** The term “geometry” refers to an understanding of geometry, spatial reasoning, and measurement concepts and principles. It involves knowledge of shapes and the ability to describe shapes in terms of dimension, direction, orientation, perspective, and the relationship among these concepts. Geometry knowledge also includes an understanding of the different measurement systems, and how to describe and represent geometry from synthetic, coordinate, and transformational approaches.

**Peer coaching.** The term “peer coaching” is the professional development process involved when master teachers work collaboratively with their peers to affect classroom instructional changes that lead to student learning successes and to teacher knowledge growth.

**Content knowledge.** “Content knowledge” is defined in this study as the knowledge specific to grade-level curriculum, which for these research participants spans Grades 4-8 mathematics, yet includes content necessary for student success in later

secondary years, as well as foundational concept knowledge important for student understanding of middle level mathematics.

**Content pedagogical knowledge.** “Content pedagogical knowledge” is defined as knowledge of instructional strategies that include being receptive to students’ multiple representations of content and context understanding, to how students develop mathematics algorithms, and aspects of various concepts’ teachability.

**Curricular knowledge.** “Curricular knowledge” includes an understanding of cross curricular connections between mathematics and other core and elective courses. It also includes knowledge of the state’s vertical mathematics standards and the district’s vertical program particulars, including the development of various mathematical strands (number concepts, algebra, geometry, and others) across several grade levels.

**Contextual knowledge.** “Contextual knowledge” in this study is defined as knowledge of district and school cultures, of the expectations and constraints of the institutions, and information about students and their communities, including student strengths and weaknesses. It also includes an understanding of district level policies and traditions that might aid or impede knowledge growth, of curricular decision-making processes at both the campus and district levels, and of community socio-economical and historical analyses.

**Community of Practice (CoP).** The term “community of practice” in this study refers to the groups that evolve naturally because of their members’ common interest and the goal of knowledge development in the educational field.

**Dispositions.** The term “dispositions” as it relates to this research is defined as those teacher leader skills, attitudes, knowledge, and behaviors that show a positive

relationship to desirable student learning and performance and those dispositions that influence changes in colleagues to help these peers achieve success for all students and the total school program. The dispositions focus on learning by teacher leaders, teacher colleagues, and students.

### **Summary and Organization of Dissertation**

The capacity of mathematics teacher leaders to promote and support change in the instructional practices of their peers to ones more aligned with recommendations from NCTM (2000) is affected by content, pedagogical content, curricular, and contextual knowledge, as well as by leadership dispositions involving competency, credibility, and approachability (Katzenmeyer & Moller, 2001, p. 47). Deep understanding of the instructional content and effective practices that lead to improved student achievement, as well as contextual understanding and leadership dispositions, facilitate teacher leaders' work with fellow teachers. The purpose of the study is to describe the perceptions about leadership characteristics of emerging teacher leaders and to discuss these perceptions in terms of state and national standards regarding leadership.

Chapter Two includes a review of the literature on teacher leaders and ill-defined leadership roles, on teacher leadership dispositions and skills, on teacher leader standards and framework, on mathematics teacher and teacher leader knowledge and beliefs, and on literature about professional development. Chapter Three describes the research design, participants and associated data, and methodologies used to assess the perceptions of this group of emerging teacher leaders. Chapter Four discusses the results of the study. Chapter Five outlines conclusions, interpretations, and implications of the study's results.

## **CHAPTER TWO**

### **REVIEW OF THE LITERATURE**

#### **Introduction**

Reform of classroom mathematics instructional practices will not occur without parallel reform in how mathematics teacher educators provide professional development for teacher leaders working with peer teachers, as well as for pre-service and in-service teachers in teacher preparation and graduate programs. Not only are the “deficiencies of the traditional approaches [to teaching mathematics] . . . becoming more apparent” (Hiebert, 2003, p. 18), so too are the inadequacies and challenges of many programs of professional learning, including those that attempt to provide leadership training and direction for instructional coaches of today’s in-service mathematics teachers.

Efforts to change teacher and teacher leader beliefs about teaching and learning require professional development activities rich in conceptual mathematics understanding and thinking (Hyde, Ormiston & Hyde, 1994). Yet mathematics teacher educators struggle to find experiences that provide promise of improving teacher practices (Seago, 2003), and promise of supporting and guiding teachers in the learning required (Ball & Cohen, 1999; Borko, 2004; Wilson & Berne, 1999). If the key purpose of professional development is to improve classroom teaching, and thus student learning, researchers must seek evidence of high-quality professional development that works to “foster teacher learning and instructional improvement” (Borko, 2004, p. 6). Weissglass (1991, 1994) proposes that such change involves more than improving teachers’ understanding of mathematics and its pedagogy, even though this knowledge is critical. Efforts that

focus on teacher feelings and beliefs are also required, he noted, to realize “personal transformation and improved collegial relationships” (1994, p. 69).

Teacher leadership roles that multiply the influences of one teacher and his knowledge nurture and encourage campus collegial relationships and collaboration in curriculum teams. Johnson (2004) found that the current generation of teachers wants to collaborate with colleagues. Johnson and Donaldson (2007) wrote if teacher leaders waited for an invitation from peer teachers or only worked with the willing, they “legitimized the traditional culture of teaching and its norms of autonomy, egalitarianism, and deference to seniority” (p. 11). When teachers are isolated from each other and not dedicated to each other’s growth, they noted, a school’s instructional capacity is static, “no more than the sum of individual teachers’ strengths and deficits” (p. 8). Teacher leadership dispositions of collegial relationships and collaboration in teams were part of this study’s research.

Individual and collaborative reflections are other teacher leadership dispositions included in the study. Teachers report they often feel isolated and are not encouraged to reflect on their work (Moller, 1999). Such reflection is critical if classroom teachers are to connect current research with practice, learn about teacher thinking as well as student cognition, and integrate these into the study of their own practice (Even, 1999). Designing professional development for emerging teacher leaders that is situated in practice (Clarke, 1994; Zaslavsky & Leikin, 2004) so participants can translate research into practice and foster collaboration, reflection, and collegiality, is a challenge mathematics teacher educators must address.

Few studies exist on the characteristics and dispositions of emerging mathematics teacher leaders. However, research about teachers and their knowledge development provides a basis for investigation of mathematics teacher leaders (Chauvot, 2009). This literature review begins with a summary of literature specific to teacher leadership and then broadens to relevant literature about mathematics teachers in general.

### **Teacher Leadership and Ill-defined Roles**

The need for shared leadership in schools becomes apparent as accountability standards rise and principals as instructional leaders find they do not have the ability alone to meet the demands. Witcher (2001) states leadership must expand to address leadership by all members of the school, especially including teachers. If school reform is to succeed, Urbanski and Nickolaou (1997) write, teachers must assume a leadership role. Distributed leadership is relational and has as its goal the empowering of others, particularly teachers (Grogan and Roberson, 2002). Spillane (2006) calls this the “stretching” of leadership across a campus, and adds that such leadership practice focuses on “interactions, not just the action of heroes” (p. 2). However, teacher leadership and the characteristics of such leadership have not been clearly nor consistently defined in much of the research literature (York-Barr & Duke, 2004). These researchers noted that conceptions of teacher leadership have evolved in three waves, as described by Silva, Gimbert, and Nolan (2000).

The first wave was one focused on teachers serving in managerial roles (department heads, lead teacher, district or union representatives, and similar positions), where campus operational efficiency and effectiveness were the goals (Evans, 1996; Wasley, 1991). In the second wave, Silva and her colleagues assert, the instructional



capability of teachers was directed at improving and writing curriculum and serving as staff developers, helping teachers, and mentors to other teachers. Wiggenton (1992) writes such positions were generally not “part of” teachers’ daily work. Darling-Hammond (1988, 2000) and Shulman (1987) note outside specialists began writing prepackaged, scripted curricular and instructional classroom materials. The third wave involves teachers as leaders both inside and outside the classroom (Ash & Persall, 2000), where teacher leaders are seen as creators and promoters of an organizational culture supporting collaboration and lifelong learning by students, by their peers, and by themselves (Childs-Bowen, D., Moller, G., & Scrivner, J., 2000; Crowther, F., Kaagen, S.S., Ferguson, M., & Hann, L., 2002; Darling-Hammond, 1988; Silva et al., 2000; York-Barr & Duke, 2004). This third wave of thinking about teacher leadership evolves from the professional model of educational restructuring as described by Elmore (1990). In contrast to the technical and client-focused models, the professional one recognizes teachers’ daily realities of teaching and values their expertise grounded in practice.

However, different opportunities for both formal and informal teacher leadership within school districts and these stages of thinking about it continue to result in a lack of clarity about the definition and roles of teacher leaders on school campuses. Even department chairperson, a familiar formal teacher leadership position on most campuses, lacks a common and recognized description (Little, 1988, 1995). Katzenmeyer and Moller (2001) lament “. . . we are a long way from a common understanding of teacher leadership” (p.4). Few studies document how teachers experience and react to teacher leadership positions and how contextual knowledge about a campus or district impacts their work (Silva et al., 2000).

The teaching profession has been slow to develop teacher leadership roles that allow differentiation, unless based on tenure. Little (1988) observes, “. . . to talk in terms of teacher leadership is to introduce status differences based on knowledge, skills, and initiative in a profession that has made no provision for them” (p. 98). Donaldson et al. (2008) note that the educational norms of “egalitarianism, seniority, and autonomy have impeded the establishment of roles that label certain teachers as more accomplished than others, that appoint them to leadership positions without regard to seniority, and that grant them a say in colleagues’ classroom practice” (p. 1091).

Some researchers define teacher leadership by what the leaders “do” and by the skills they possess. York-Barr and Duke (2004) in their synopsis of “what teacher leaders do” within the various dimensions of their practice identify seven distinct categories (p. 266). These include coordination and management, school or district curriculum work, staff development for colleagues, participation in school improvement activities, parent and community involvement, professional contributions, and pre-service teacher education. Two of these (professional development of colleagues and participation in school change/improvement) match what typically happens with campus-based teacher leaders and peer coaches. What teacher leaders do in these two categories, according to these researchers and others, includes modeling and encouraging professional development (Silva et al., 2000; Smylie & Denny, 1990; York-Barr & Duke, 2004); mentoring other teachers (Archer, 2001; Darling-Hammond, Bullmaster, & Cobb, 1995); participating in peer coaching (Berry & Ginsberg, 1990; Devaney, 1987; Guiney, 2001); working with peers to encourage school change (Darling-Hammond et al., 1995;

Silva et al., 2000); and confronting and challenging change and improvement barriers in school culture and structure (Crowther et al., 2002; Silva et al., 2000).

The need to identify, support, and keep successful teachers in the classrooms prompts calls for increased involvement by peer teachers in school instructional and decision-making processes (Ingersoll, Alsalam, Quinn, & Bobbitt, 1997). Susan Moore Johnson (2004) writes that the “next generation of teachers seeks a range of roles, both within the classroom and outside by which to exercise broad influence” (p. 19). Higher retention rates are found on campuses that have good working conditions and peer recognition (Rosenholtz, 1991). Emerging teacher leaders seek the appreciation of their colleagues, parents, and administrators, as well as the reward of feeling their students are successful learners.

However, sharing of campus instructional leadership can be complicated by lack of clarity of the purpose of school-based staff development, the failure of campus and district leadership to encourage and support peer teacher leaders as they work with other adult learners, the teacher leader’s lack of resources and influence or authority to bring about change, and the inherent tendency of school cultures to resist change (Johnson & Donaldson, 2007; Richard, 2004). Although district-level administrators may implement such programs, they may lack the authority to convince campus-level administrators to try such programs or to support the teacher leaders. Additionally, the responsibilities of school-based staff developers vary from school district to school district, and sometimes from school to school within a district.

Many campus-based mathematics teacher leaders are chosen for the position because they have shown teaching excellence in their own classrooms. Unfortunately,

that effectiveness can be undermined when instructional coaches transition from a peer to a peer coach without professional development and on-going support to prepare them for the resistance and school culture changes they may face in their new roles (Richard, 2004). In a recent study of experienced teachers transitioning to mathematics coach positions at the elementary level, one group of researchers, Chval et al. (2010), examined the roles and identities of novice mathematics coaches, and also focused on the “doing” piece of instructional coaching. They noted the difficulty of transitioning from an expert classroom teacher to a beginning mathematics coach, and highlighted four categories of additional professional identities an effective instructional coach must master. These identity roles (how the coaches spent their time) included the following elements:

1) Mathematics coach as a supporter of teachers; 2) Mathematics coach as a supporter of students; 3) Mathematics coach as a learner; and 4) Mathematics coach as a supporter of the school-at-large. The researchers found these mathematics coaches had perceptions of lack of clarity about their roles. They had a sense of isolation similar to, yet different from, the experiences of non-supported classroom teachers. However, the study’s participants found positive results and improved teacher practices from their work.

Although a consistent definition of teacher leadership eludes the profession (Katzenmeyer & Moller, 2001; Wasley, 1991; York-Barr & Duke, 2004), some researchers have stated their perceptions. York-Barr and Duke (2004) described teacher leadership as a process “by which teachers, individually or collectively, influence their colleagues, principals and other members of the school communities to improve teaching and learning practices with the aim of increased student learning and achievement”

(pp. 287-288). Teacher leadership, according to Urbanski and Nickolaou (1997), is collegial in nature. Crowther et al. (2002) propose it is “action that transforms teaching and learning in a school that ties school and community together on behalf of learning...” (p. xvii). Katzenmeyer and Moller (2001) write, “Teachers who are leaders lead within and beyond the classroom, influence others toward improved educational practice, and identify with and contribute to a community of teacher leaders” (p. 6). Lieberman and Miller (2002, 2004) propose that teacher leadership occurs when teachers move from a managed view (where their work is a prescribed set of skills, behaviors, and techniques) to an inquiry view. They purport teacher leaders then assume new roles as “researchers, meaning makers, scholars, and inventors” (2004, p. 11).

### **Teacher Leader Dispositions and Skills**

The National Council for the Accreditation of Teacher Education (NCATE) defines teacher dispositions as the values and characteristics that define teacher performance and equate to ethics, perceptions, attitudes, and commitments (NCATE, 2000). Ritchhart (2001) notes the active nature of dispositions:

Thinking dispositions represent characteristics that animate, motivate, and direct abilities toward good and productive thinking and are recognized in the patterns of one’s frequently exhibited, voluntary behavior (p. 145).

Dispositions as a way of thinking about teaching and learning is the focus of the research of Thornton (2006):

Dispositions are habits of mind including both cognitive and affective attributes that filter one’s knowledge, skills, and beliefs and impact the action one takes in classroom or professional setting. They are manifested within relationships as

meaning-making occurs with others and they are evidenced through interactions in the form of discourse (p. 62).

Much has been written about the dispositions considered key to success of classroom teachers, but little research has been published about what dispositions are important to the development of the construct of teacher leadership. Researchers studying teacher leadership note that expanded knowledge and perspectives and learning to work effectively with others are sets of skills teacher leaders must learn and practice (Katzenmeyer & Moller, 2001; O'Connor & Boles, 1992; Sykes, 1999).

Crowther, Hann, McMaster, and Ferguson (2000) suggest these leadership skills should not vary from those considered critical for preparation of principals. Katzenmeyer and Moller (2001) agree, writing those learning to become principals and those learning to become teacher leaders should learn together about the leadership construct (p. 133). Hackney and Henderson (1999) add, "It is our premise that we must discontinue the separate graduate education of future principals and teachers. . . . We must begin educating a generation of administrators and teacher leaders who accept and endorse the notions of democracy and a school centered on continuous reflection and inquiry (p. 73)." They noted that school leadership will require both administrators and teacher leaders who understand how to work cooperatively in schools. Crowther et al. (2002, p. xvii) label this cooperation *parallel leadership*. This latter research group describes their paradigm of teacher leadership in their *Teacher as Leader Framework*, focusing on dispositions of optimism, authenticity, encouragement of communities of learning, confrontation of barriers, maintenance of sustainable systems of action, and nurturance of cultures of success (Crowther et al., 2002). Major and Brock (2003) note ethical issues

related to diversity. Several researchers (Shutz, Keyhart, & Reck, 1996; Zeichner, 1996) focus on perceived negative dispositions that lead teachers to view some backgrounds as deficient.

Danielson (2006) writes that teacher leaders have the following skills:

1) They routinely use evidence and data to make decisions; 2) They possess the ability to recognize an opportunity and the desire to seize the initiative; 3) They are able to convince and engage others to participate in their vision; 4) They are committed to action, including the acquisition of needed resources; 5) They actively monitor and reflect critically about progress and consequences; 6) They have the ability to persuade others to sustain their involvement and commitment and effectively deal with any encountered negativity; and 7) They ensure that sharing of improved practice becomes part of the “school’s collective wisdom” (p. 35). In work with identified expert teachers, Steffy, Wolfe, Pasch, and Enz (2000) also noted they are proactive and anticipatory teachers. Such teachers “. . . are able to teach any student in any setting” (p. 78).

Teacher leaders’ competence, therefore, includes strong interpersonal, organizational, and teaching skills. York-Barr and Duke (2004), during their comprehensive review of the literature in an attempt to develop a conceptual teacher leadership framework, frequently found characteristics of relationship building and collaboration (p. 265).

### **Teacher Leadership Standards and Framework**

Recent efforts to bring a vision of excellence and equity in mathematics education to all children have resulted in state programs for the development of mathematics teacher leaders to work with other teachers as mentors or coaches, and with students to improve student mathematics performance. In Texas, this program is titled

the Master Mathematics Teacher (MMT) certification program. On the national front, the National Council of Supervisors of Mathematics (2008) recognized the same need and developed a mathematics teacher leadership framework.

Although the school district and/or campus where the MMT is based determine his or her responsibilities, the Texas Education Agency (2010) notes the primary duties are to teach mathematics and to serve as a mathematics teacher mentor to other teachers. The state further defines the work of these master teachers as applying the interrelated mathematics content concepts and components from all grade levels to prepare, deliver and monitor appropriate mathematics instruction. The state maintains appropriate mathematics assessment should be used to inform and adjust instruction and that an understanding of the range of mathematical achievement should dictate effective instructional approaches. Instruction must be based on the state's curriculum, Texas Essential Knowledge and Skills (TEKS), in mathematics at the appropriate grade level, and a positive learning experience created to promote attitudes and equitable opportunities so that all students achieve at high levels. The state's MMT Standards I-V deal with content understanding in number concepts, patterns and algebra, geometry and measurement, probability and statistics, and mathematical processes; Standard VI attends to effective instruction and classroom management and Standard VII focuses on the importance of a positive learning environment, including student attitudes and equitable opportunities for all students. Standard VIII deals with formative and summative assessment. Standard X focuses on the historical development, structure, and evolving nature of mathematical ideas and the connections between mathematics and society.



Finally, Standard IX, Mentoring and Leadership, (Appendix A) addresses the work master mathematics teacher leaders do with other educational stakeholders, and the second major piece of what certified MMTs are charged to do: provide leadership and mentoring to facilitate standards-based and research-based mathematics instruction. Expectations from this standard are that these teacher leaders will communicate and collaborate with all members of the community – peers, other professionals, parents, and administrators. The MMT provides professional development for faculty, coaches and consults with peer colleagues, and uses data and evidence from research to make program decisions. This study's participants are preparing for such teacher leadership roles.

Recognizing the impact such teacher leaders can have on the effectiveness of their peers, the board of the National Council of Supervisors of Mathematics (NCSM) resolved in 2006 to move forward with a standards framework that would delineate the mathematics leadership principles, indicators, and actions the organization should endorse. The acronym PRIME – PRinciples and Indicators for Mathematics Education Leadership – was chosen to describe the efforts underway and the PRIME leadership framework was written (NCSM, 2008). It is reproduced in Appendix B, which lists its four principles and their indicators. The framework's aim is to describe the complex work of mathematics teacher leaders, Pre-K through 12, as they address the four domains of mathematics leadership: equity, teaching and learning, curriculum, and assessment. The framework further identifies three specific indicators of leadership in each of these domains. In turn, the indicators are broken down into

. . . specific actions that fall on a continuum of *three stages of leadership growth* ranging from knowing and modeling leadership, to collaborating and

implementing structures for shared leadership on a local level, to advocating and systematizing improvements into the wider educational community (p. 2).

The underlying framework assumptions are learning success for every student, teacher, and teacher leader across all school settings, research-informed teacher practices, and teacher collaboration and professional learning. The council notes teacher collaboration and professional learning are supported by research that indicates that to improve mathematics and science achievement for all students, there must be improved mathematics and science teaching (NCSM, 2008, p. 3). Because NCSM seeks to foster a better future in mathematics education, research-informed indicators of leadership accompany each of the four principles (equity leadership, teaching and learning leadership, curriculum leadership, and assessment leadership). The organization acknowledges that the leadership process is complex. They state, however, that the key to teacher leadership is the “ability to help teachers collaborate with one another” (p. 6), restating the necessity to foster communication and collaboration.

This researcher combined the NCSM principles and indicators and characteristics from Standard IX of the Texas Master Teacher Program into a framework to analyze characteristics and dispositions for selection and inclusion in one of the interview questions. That framework, Appendix C, was used to determine which characteristics and dispositions were thought most critical by state and national policymakers to the work of mathematics teacher leaders.

### **Mathematics Teacher and Teacher Leader Knowledge and Beliefs**

The knowledge of mathematics content by teachers is thought to be critical for their teaching of concepts and computation to mastery (Kilpatrick, Swafford, & National

Research Council (U.S.), 2002). These researchers also point to the importance of teachers being able to effectively and consistently help a wide variety of students learn worthwhile mathematical content in a multiplicity of circumstances and across various content strands. Closely aligned to teacher knowledge is teacher leader knowledge and it is parallel to teacher knowledge in importance to the work of school-based teacher leaders with a wide range of teachers on their campuses.

Mathematics teacher and teacher leader knowledge are collections of living, constantly changing components, including conceptual, procedural, and contextual knowledge, knowledge of mathematical representations, and an understanding of how students, teachers, and adults learn. Additional components include knowing how mathematics and mathematical teaching are best undertaken at the introduction, practice, and mastery levels, and how to facilitate learning for all students (Ball, 1991; Fennema & Franke, 1992; Lampert, 1989; NCTM, 2000).

Researchers, policymakers, teacher educators, and school administrators see teachers' mathematics content knowledge as the most important variable in student learning. "Knowledge of mathematics is obviously fundamental to being able to help someone else learn it" (Ball, 1988, p. 12, as quoted by Fennema and Franke, 1992, p. 148). Ball noted the importance of *mathematical knowledge for teaching*, described as an "in-depth knowledge of the specific math needed for their classes and how to make it understandable to students" (Cavanagh, 2008, p. 2) in comments about *The Final Report of the National Mathematics Advisory Panel* (U.S. Department of Education, 2008). Mewborn (2003) noted that strong content understanding translated into stronger mathematical learning by students in several studies (Fernández, 1997; Swafford, Jones,

& Thornton, 1997). However she wrote teacher content knowledge alone will not necessarily make one an effective teacher. Mathematics teacher knowledge also involves being able to “hear students flexibly, represent ideas in multiple ways, connect content to contexts effectively, and think about things in ways other than ...[one’s] own (Ball, 2000, p. 242).” The study of Thompson and Thompson (1994) also noted that misunderstandings can occur when teachers do not attend to what students are communicating about their thinking, hearing what the students are saying.

Pedagogical content knowledge, or  
 . . . teacher’s knowledge of students’ mathematical thinking and learning, is  
 widely believed to be an important component of teacher knowledge, (although) it  
 remains underspecified, and its relationship to student achievement  
 undemonstrated (Hill, Ball, & Schilling, 2008, p. 373).

Likewise, mathematics teacher educators’ knowledge of their students (whether pre-service, in-service, or peer teachers) is not well understood. Research about knowledge growth of mathematics teacher educators is limited. Most of the research currently focuses on the work of faculty, adjunct instructors, and graduate students working with pre-service and in-service teachers.

The historical socio-cultural context within which knowledge emerges also shapes the meaning attached to teaching and learning. Olson (1995) notes:

What we choose to attend to, and thus what we choose to make sense of from our  
 experience, depends on both our individual continuity of experience and our  
 interaction in context with the world (p. 120).

Institutional context thus influences the narrative of experience.

Several researchers have provided conceptual frameworks for viewing the complexity of teacher knowledge development. Tzur (2001) in his self-study indicated that it occurs via “reflection on activities” (p. 260). Using the analyses of fragments of his experience, Tzur developed a four-foci model for his mathematics teacher educator development: a) learning mathematics as a student, (b) learning to teach mathematics as a teacher, (c) learning to teach mathematics teachers as a teacher educator, and (d) learning to teach mathematics teacher educators as a mentor. Sztajn, Ball, and McMahon (2006) suggested using *mathematical knowledge for teaching* (Hill et al. 2008; Cavanaugh, 2008) as a “common intellectual space” for investigating the development of mathematics teacher educators during professional development.

Zaslavsky and Leikin (2004) offered a three-layered model of growth through practice which incorporates Steinbring’s (1998) model of teaching and learning and Jaworski’s (1992) teaching triad. Steinbring’s model is described by Zaslavsky and Leikin (2004) as the teacher offering a “learning environment for his or her students in which the students operate and construct knowledge of school mathematics in a rather autonomous way” (p. 8). They noted students then are expected to make subjective interpretations of their activities and reflect on their work. Jaworski’s triad, analyzed and synthesized for mathematics teacher educators by Zaslavsky and Leikin (2004) includes a) management of teachers’ learning, b) sensitivity to mathematics teachers, and c) challenging content for mathematics teachers. These researchers suggest the mathematics teacher educator’s “growth-through-practice” will be enhanced by reflection using their three-layered model. Jaworski’s (2003) framework proposal includes reflexive pairs *knowledge and learning, inquiry and reflection, insider and outsider,*

*individual and community* (p. 262). She suggested that her framework “. . . might be used to initiate research or to analyse existing research in order to understand better its characteristics of contribution to teaching development” (p. 264), and provides three sample analyses using the framework.

Mathematics teacher and teacher leader content knowledge and pedagogy knowledge can also be focused by their beliefs about what constitutes mathematics learning. If they see mathematics learning as terminology and procedural methods and operations, they may present work from textbooks and worksheets and look for results that match the text or answer sheet. If teachers or teacher leaders look to conceptual understanding as the foundation of mathematics learning, they may challenge students to justify methods and defend their results in ways that make mathematical sense. Cohen (2008) reports that such teachers “cultivate students’ capacity to make persuasive mathematical arguments, and they treat teaching and learning about the difference between mathematically defensible and indefensible justifications as no less important than methods and results” (p. 365). He contends that the first group of teachers gives no attention to result justification.

This researcher acknowledges the messiness of the construct belief (Parjares, 1992), and that “. . . (d)istinguishing knowledge from belief is a daunting undertaking” (p. 309). Researchers Fennema and Franke (1992) wrote “it is impossible to separate beliefs and knowledge” (p. 147). Thompson’s (1992) review of research on teacher beliefs offered several explanations for the lack of clear delineation between knowledge and beliefs. The first is the difficulty in separating the two in the minds of many teachers (Grossman, Wilson, & Shulman, 1989). Another concern, wrote Thompson, assesses the

value of even attempting to do so. Although educational researchers carefully consider the philosophical and psychological meaning of belief, the focus, she suggested, should be on how either beliefs or knowledge (or both) impacts teacher experiences and possibly practice (Thompson, 1992, p. 129).

Research on the beliefs that teachers hold about teaching and learning shows their impact on classroom instructional practices (Leder, Pehkonen & Tömer, 2003, as cited in Ambrose, Clement, Phillip, & Chauvot, 2004; Phillip et al., 2007; Pajares, 1992; Thompson, 1992). Beliefs about the nature and meaning of mathematics similarly effect teacher practice (Seaman, Szydlik, Szydlik, & Beam, 2005; Collier, 1972); yet an understanding of these beliefs is complicated by the lack of distinct definitions for knowledge and beliefs as used in the research literature (Parjares, 1992; Thompson, 1992), as well as by the instruments used to measure beliefs and classroom practices.

Parjares (1992) argues “distinguishing knowledge from belief is a daunting undertaking” (p. 309), pointing to the need to include both affective and evaluative components when researching cognitive knowledge. He laments that many researchers use the following definition: “Belief is based on evaluation and judgment; knowledge is based on objective fact” (p. 313). Additionally, Rokeach (1968) asserted beliefs have a cognitive component, an affective component, and a behavior component.

These multi-dimensional aspects of beliefs present difficulties in construct definition and measurement design. The exact nature of the teacher efficacy construct, for example, seems affected by many variables: content, context, classroom management skills, student ability (or lack thereof), outcome expectancy, willingness to try new approaches or materials, as well as organizational and planning skills. This multi-

dimensionality results in the numerous construct measurement scales and construct definitions that have developed over the past several decades (Bandura, 1986; Emmer & Hickman, 1991; Gibson & Dembo, 1984; Guskey & Passaro, 1994; Rose & Medway, 1981; Rubeck & Enochs, 1991).

Limitations in the measurement of both belief and practice complicate important research on instructional practice (Pajares, 1992; Ambrose et al., 2004). Much of the research on belief and practices of mathematics, as well as changes that occur over time in teacher beliefs and practices, uses quantitative methods of analysis, primarily Likert-scale surveys. However, self-report surveys and problems with either/or items may mask important subtle differences in beliefs. Concerns about reliability and validity of the self-reported data also persist, as does the problems of surveys that “produce data which represent hypothetical situations” (Fang, 1996, p. 56).

One group of researchers (Ravindran, Debacker, & Greene, 2005) were surprised by results regarding meaningful engagement found by using self-report surveys with a six-point Likert-type scale to examine achievement goals, epistemological beliefs, cognitive engagement, and application learning of pre-service teachers. They noted, “the failure of meaningful cognitive engagement to predict learning was a surprise” (p. 230). These researchers reported the failure of the Epistemological Questionnaire of Schommer (Schommer, Crouse, & Rhodes, 1992) to measure all epistemological beliefs included in Schommer’s (1994) conceptualization of them. In a discussion of alternative self-report instruments, the authors noted their strengths and weaknesses, and turned to the Epistemological Beliefs Inventory for their study.



Recently, hybrid surveys (like the Constructed-Response-Format Beliefs Survey, rubric-based model of Ambrose et al., (2004)), have been developed. These researchers recognized some weaknesses of their instruments, designed to measure beliefs about whole number place value and rational numbers among pre-service elementary teachers. “This survey may have been different were it intended for different content – say geometry – or for a different population – say pre-service secondary school teachers” (p. 63). They also note that rubric development requires “time, money, and large numbers of persons qualified to develop and code rubrics” (p. 63).

Some researchers (Brookhart & Freeman, 1992; Munby, 1984; Schunk, 1991) suggest qualitative research (case studies, interviews, observation of classroom practice, narrative, and responses to video vignettes) will provide information about beliefs that may be hidden in strictly quantitative research.

### **School-based Professional Development**

Campus-based teacher leaders have an important role in providing professional development and in encouraging reform in classroom practices. They possess an important and unique perspective because they often teach several classes of students in addition to providing support to their peer teachers. They can react to change suggestions and reform initiatives and support their co-workers from a viewpoint that is not far removed from the classroom. They can implement initiatives in tandem with peer teachers, collaborate about difficulties and successes, and suggest changes that benefit all campus classrooms.

The kind of teaching called for by the reform goals suggested by NCTM (2000) has been described as *transformative*, or requiring sweeping changes in intensely held

beliefs, knowledge and habits of practice, as opposed to *additive*, involving the addition of new skills to an existing repertoire (Thompson and Zeuli, 1999). Since staff professional development programs organized as workshops or lectures are isolated from the teachers' classroom responsibilities, they are not sufficient to change teachers' instructional practices, and ultimately student learning and teacher beliefs and attitude.

Guskey's (1986) model for the process of teacher change noted that there would not be a change in teacher beliefs and attitudes unless first there is a change in teachers' classroom practices that lead to a change in student learning outcomes. Clarke (1994) suggests that campuses and districts should recognize that changes in beliefs about teaching and learning only follow classroom practice. Classroom practice is where teachers have the opportunity to validate knowledge received from professional development by observing positive student learning results and to step back from their own learning and focus on its implications for their students' learning. Margaret Schwan Smith (2001) also takes the stand that professional development should be situated in practice.

To become effective professional practitioners, Castle and Aichele (1994) write that teachers must develop their own vision of professional development. Programs that foster this professional autonomy put mathematics teachers in control of their own learning, yet encourage reflective collaboration with peers. They write, "They can articulate to others their views on education issues and construct their own theories of what constitutes good teaching" (p. 7). Fosnot (1989) suggests teacher education programs follow this model:

Rather than dispensing a list of prescribed methods of instruction to

preservice teachers for their use, these teacher candidates themselves need to be immersed in an environment where they are engaged in questioning, hypothesizing, investigating, imaging, and debating. They need to be part of a community that actively works with them as *learners* and then allows the experience to be dissected, evaluated, and reflected upon in order for principles of pedagogy and action to be constructed (p. 21).

School-based professional development provides this flexibility for teacher and teacher-leaders.

Certain characteristics of professional development have been identified as having a positive influence on teachers' classroom practice and student achievement. These include teachers' focus on content and the students' learning of the content; collaborative, active learning activities with teaching peers from your own campus and/or content area; teacher learning opportunities of some duration; and teacher leadership opportunities during professional development (Desimone, Porter, Garet, Suk Yoon, & Birman, 2002; Desimone, Smith, & Ueno, 2006). Collaborative reflective practice and analysis with colleagues or a new teacher is an often overlooked professional development opportunity in American school systems (NCTM, 2000; Stigler & Hiebert, 1999) and can provide desired characteristics that support student achievement.

An area of unease is the scarcity of studies on the professional development of mathematics teacher educators, mainly novice and generally untrained mathematics teacher educators and mathematics teacher educator educators (Tzur, 2001; Zaslavsky & Leikin, 2004). Increasingly these mathematics teacher educators are mathematics coaches or facilitators providing on-going job-embedded professional development in

their roles as campus teacher leaders. They are often ill-prepared, unfocused, and have little guidance about expectations other than that campus accountability measures will improve. Little research has been conducted on how best to prepare these teacher leaders for the critical work they perform with peer teachers.

### **Summary**

Although few studies exist on the characteristics and perceptions of emerging mathematics teacher leaders, research about teachers and their knowledge development provides a basis for an investigation of mathematics teacher leaders. The roles of teacher leaders vary, often defined by the contextual circumstances they face, by the administrative expectations of campus and district administrators, and certainly by the skill and knowledge base they bring to the profession and cultivate in their positions. Campus-based teacher leaders occupy a unique position in the frontlines of teaching and learning on campuses and they have a valued perspective from which to view change and reform. Their input and an understanding of their perspectives about the characteristics and dispositions of value to their profession could guide the future development of leadership trainings and development programs.

## **CHAPTER THREE**

### **METHODOLOGY**

#### **Introduction**

The purpose of this study is to describe emerging middle school mathematics teacher leaders' perceptions of characteristics and dispositions important to their work, or future work, with peer teachers in school-based learning situations. The participants are involved in professional development related to number concepts, algebraic thinking, geometry and measurement, probability and statistics, and the construct of leadership within a middle school master mathematics teacher preparation program. Because they are preparing for certification as a Master Mathematics Teacher (MMT) in the State of Texas, the study also investigated the alignments of their perceptions to the standards set forth in the state program, particularly those related to those portions of Standard IX (Appendix A) involving communication, collaboration, mentoring, coaching, and consultation, and to the principles and indicators set forth in the PRIME Leadership Framework of the National Council of Supervisors of Mathematics (NCSM, 2008) detailed in Appendix B. Other parts of Standard IX involve providing professional development opportunities and making instructional decisions based on data and supported by research evidence. These components are important to the work of teacher leaders in school-based staff development and join the earlier noted standards areas as focuses of this research.

To achieve this purpose, the following research questions were posed:

Research Question One. What characteristics and dispositions do emerging middle school mathematics teacher leaders perceive as important to their work with peer teachers in a school-based learning situation?

Research Question Two. Based on these perceptions, how do the teachers interpret the State of Texas Master Mathematics Teacher Standards?

Research Question Three. Based on these perceptions, how do the teachers understand the principles and indicators for mathematics educational leaders contained in the PRIME Leadership Framework of the National Council of Supervisors of Mathematics?

### **Research Design**

The complexity of middle school mathematics classrooms and their numerous pressures, interactions, and variables requires a research investigation that provides opportunities to investigate the perceptions of the richness and detail of teaching and learning and leadership. Therefore, the study used qualitative research methods to examine the emerging teacher leader participants' experiences and their perceptions about the characteristics and dispositions of leadership practice required to effectively work with peer teachers in school-based staff development.

Stake (1995, 2005) writes that an *intrinsic case study* is undertaken to have a better understanding of a particular case, whether a teacher, a conference, a curriculum, or a program:

It is not undertaken primarily because the case represents other cases or because it illustrates a particular trait or problem, but instead because, in all its particularity and ordinariness, this case itself is of interest. The research at least temporarily

subordinates other curiosities so that the stories of those “living the case” will be teased out (2005, p. 445).

Stake (2005) uses the term *instrumental case study* when a particular case study is undertaken to mainly “provide insight into an issue or to redraw a generalization” (p. 445). The case is of secondary interest as

. . . it plays a supportive role, and it facilitates our understanding of something else . . . There is no hard-and-fast line distinguishing intrinsic case study from instrumental, but rather a zone of combined purpose (2005, p. 445).

This is a qualitative case study investigating the emerging teacher leaders’ understanding of their and other teacher leaders’ characteristics and dispositions, and falls into a combined purpose category because of its focus on five individuals in a particular program and on the issues surrounding the leadership construct and its characteristics.

The research focused on a naturalistic, interpretive approach to the “world of lived experiences . . . where individual belief and interaction intersect with culture” (Denzin & Lincoln, 2003, pp. 12-13). To obtain information about their perceptions, the researcher conducted semi-structured interviews. The interview protocol is included in Appendix D. Appendix C aided the researcher in the identification of mathematics teacher leadership characteristics thought important by state and national policymakers. These characteristics were incorporated in the final question in the interview of participants. The interviews were transcribed and further analyzed for participants’ understandings of the construct of leadership and its characteristics in cross analyses that looked for patterns and commonalities (see Appendix E). Less formal observations included in the field notes gathered during the interview process incorporate

Carspecken's (1996) cautions about using low inference wording and "by distinguishing between objective-referenced data and observer comments" (p. 48).

It was anticipated the researcher would obtain different insights about the participants' own understanding of the construct of leadership during the analyses processes. This researcher's nine years as an elementary and secondary mathematics teacher leader and three as a high school mathematics teacher added additional understanding and insight to the leadership construct.

## **Data Collection**

### *Research Site Context*

The program from which research participants were drawn is one of several state approved MMT certification preparation programs created to provide teachers with knowledge and skills to work with other teachers as mentors, coaches, and consultants, and with students to improve mathematics performance. These courses of study are offered, after a state review and approval process, at some regional service centers of the state board of education and at several state universities. The state provides MMT certification for teacher leaders in Early Childhood (EC) through Grade 4 assignments, in Grades 4-8 assignments, and in Grades 8-12 assignments. These certified teacher leaders are expected to spend one-half of their school day as classroom teachers and the remaining portion as peer mentors once they receive MMT certification. The program of research interest provides MMT certification for Grades 4-8.

The program calls for both mathematics content and pedagogy to be covered in a series of four semester courses with a fifth semester course that focuses on teacher leadership and teacher change. The four content-related courses are team-taught by the



Department of Mathematics and Department of Curriculum and Instruction at an urban university in southwestern United States. The Fall 2009 course focused on the development of number concepts; in Spring 2010, coursework highlighted algebraic thinking. Summer 2010 coursework focused on probability and statistics; Fall 2010, geometry and measurement. All program enrollees were invited for the research study. The five participants who agreed to participate fell into one or more of three categories (teachers with less than five years of classroom experience, teachers with greater than five years of experience, and those currently serving in teacher-leader roles on their campus or within their district).

The teachers met weekly in face-to-face three-hour classroom sessions Fall 2009 and Spring 2010, spending approximately one hour and 30 minutes of the class time on mathematics content instruction and a similar amount of time on activities and discussion related to curriculum theories, lesson planning and implementation, instructional strategies, and formative and summative assessment. During Summer 2010, they met weekly on-line for mathematics content instruction and weekly face-to-face in sessions related to curriculum and mathematics pedagogy. They also responded on-line to discussion and reflection questions about research and professional publications, and submitted content homework and coursework on-line and/or in paper and pencil format. Mid-term and final exams, case studies about student learning and teaching by peers, and preparation for practicum activities were part of the participants' studies, but were not part of this study's data.

The researcher was introduced to the participants during an early session of the professional development as an evaluator of the program (not as a participant observer

nor course instructor), which began Fall 2009 and extended over 24 months. The researcher attended those classroom sessions that did not involve summative assessments requiring a testing environment. She recorded significant comments during presentations and classroom discussion for contextual understanding of the participants and their viewpoints. The researcher also administered throughout the program pre- and post-test Diagnostic Teacher Assessments in Mathematics and Science (DTAMS) in her role as one of the program evaluators.

The researcher has served in mathematics teacher leadership positions in three public school districts for nine years and these assignments have focused on science and mathematics Grades Pre-K through 12. For three years, the researcher was a mathematics and science instructional coach for two schools and two special district programs in a large suburban district (serving over 30,000 students) in a major southwestern U.S. city. The assignment included work with mathematics and science teachers at a high school for students at risk of dropping out of high school, a charter middle school (Grades 6-8) for advanced students, the district's alternative school program for students with behavior issues (Grades 6-12), and a newcomer's program for Grades 9-12 students who had been in the country for less than two years and whose English language development was rated inadequate to be successful on their home campuses.

For the past six years, the researcher worked in a smaller suburban/semi-rural district outside the same city that serves approximately 5,500 students. In the past three years her primary focus has been on mathematics teaching and learning in Grades 5-12, after three years working with students and teachers Pre-K-12 in both mathematics and

science. During that timeframe, the researcher worked with teachers at two junior highs (Grades 6-8) and one high school, and mentored a district elementary mathematics specialist whose work is involved with teaching and learning on five elementary campuses (Grades Pre-K-5). Recently she moved to another nearby suburban 6,500-student district where her role is mathematics coordinator for grades Pre-K-12 on eight campuses. The researcher's main function in all three districts has been to support teachers and teacher leaders in learning communities focused on collaboration, assessment for learning, teaming, and reflection on practice. Because her current and last districts are fairly small, non-mathematics related responsibilities (college and career readiness, the gifted and talented program, teacher recognition, and other programs) provide the researcher with background to understand the additional demands many districts in the state, and their campuses, place on content-area coaches and specialists.

### *Participants*

The five study participants were members of a 17-teacher cohort that began studies for MMT Grade 4-8 certification in Fall 2009. They included three classroom teachers, one nascent campus teacher leader who did not have classroom responsibilities, and one nascent campus teacher leader who also taught several classes of students at her middle school. They all held teaching certifications for the targeted grade levels and will have at least three years of teaching experience at the completion of the 24-month program, when they will be required to pass a state examination to receive Middle School Master Mathematics Teacher certification. Additionally, they met requirements to pursue mathematics education graduate study at the major southwestern United States urban university which provides the program instruction, and will receive appropriate graduate

credit towards either a master's degree or a doctorate in curriculum and instruction, mathematics education. Some members of the cohort began the 24-month MMT program in Fall 2009, and three additional mathematics teachers joined the program in Summer 2010. They were therefore an *expedient selection* as described by Freebody (2003). They were engaged in studies relevant to the research.

The 17 program participants included teachers who hold generalist certifications, Grades 4-8, and those who hold mathematics certifications, Grades 4-8. The state standards for these two certifications are similar, although the generalist certification does not have as extensive a focus on the content and content pedagogy of mathematics as do the standards for the mathematics certification, Grades 4-8. Only 23% of the tested areas on the certification for Generalist, Grades 4-8, are mathematics areas, while 100% of the tested areas in the certification for Mathematics, Grades 4-8, involve mathematics instruction. The teaching assignments of the 17-member cohort varied, from Grades 4 through Grades 8, including Algebra I offered to Grade 8 students, and intensive remediation for all grade levels. Therefore, some program enrollees hold additional certifications, including special education and the secondary mathematics certification necessary to teach Algebra I to Grade 8 students. The assignments of the five participants are further explained in Chapter 4, Findings. These participants are characterized in Figure 1, Participant Descriptions.

**Figure 1. Participant Description**

<b>Participant Pseudonym</b>	<b>Teacher Description</b>	<b>Tenure</b>	<b>Current Assignment</b>	<b>Certification</b>
Donna	White Female	Teaching, 9 years	Teacher, Computer Science, Grades 6-12. Private school serving Grades PreK-12	Grades 4-8, Generalist
Fran	White Female	Teaching, 7 years Leading, 2 years	Teacher, Mathematics, Grade 6 Department Chair, Grades 6-8, Public Middle School	Grades 4-8, Generalist
James	Black Male	Teaching, 8 years Leading, 1 year	Mathematics Interventionist/Coach, Grades PreK-4, Public Elementary School	Grades EC-6, Generalist Grades PreK-12, Special Education
Lucy	White Female	Teaching, 3 years	Teacher, Mathematics and Science, Grade 5, Public Elementary School	Grades 4-8, Generalist
Tomas	Hispanic Male	Teaching, 3 years	Teacher, Title I Mathematics Interventionist, Grade 8, Public Middle School	Grades 4-8, Generalist

### Data sources

The responses of participants gathered during semi-structured interviews in the Summer and Fall of 2010 comprise the primary data of this research. These responses were analyzed to reference the teachers' understandings of the knowledge and skills important to assisting peer teachers. The responses were further analyzed to compare and contrast agreement to the standards set by state and national policymakers (portions of Standards VI-IX for MMT certification for Grades 4-8 and NCSM Prime Leadership Framework for mathematics teacher leaders.) Contextual background information was provided by the researcher's observations during classroom meetings of participants, their responses to reflective on-line activities, as well as requirements of both the state and university for participation in the program, but was not the primary data for this research. Sources of data therefore included the following: participant interviews, field

notes, MMT *Standards* and relevant documents and PRIME Leadership Framework documents.

### *Participant interviews*

Five emerging teacher-leaders were interviewed during the primary data collection phase which lasted three weeks at the beginning of the 2010-2011 school year. Each face-to-face interview lasted from 40 to 70 minutes and was conducted in a location convenient to the participants. Participants had permission to refuse to answer any questions, or to end the interview at any time, but none did so. Two interviews occurred in a study area of the community college where the teachers have their program instruction. One interview took place in a study carrel at a local county library and one in the classroom of the teacher at her campus. The final one was in the dining room in the suburban home of one of the participants. Short face-to-face and telephone follow-up interviews to clarify currently-held teaching certifications occurred later during the study. Most of the interview data, therefore, comes from the initial singular occasions; each interview was transcribed and given to the participant to review. No corrections were requested.

The interview protocol (Appendix D) was carefully prepared to ensure the questions could capture the emerging teacher leaders' perceptions about teacher leadership and its characteristics. One question focused on how the participants were mentored or coached themselves in their early teaching careers; another asked for their description of how teacher leaders facilitated the participants' professional growth. Two questions asked the participants to detail their own mentoring of new or struggling teacher(s), or of student teachers. These four questions asked for details about any

negative or positive aspects of the experiences, and about how attributes of the teacher leaders who worked with them, how attributes about themselves, and how attributes about their campuses contributed to any negative or positive aspects of the experiences. The teachers were also asked about their teaching strengths and about an area of their teaching they would like to improve upon.

The final question drew their attention to nine characteristics or dispositions identified by state and national mathematics leaders as important to the work of mathematics teacher leaders. The question asked study participants to allocate points from a total of 100 to those characteristics they ranked as important for being an effective middle school mathematics teacher leader. They were also allowed and encouraged to add any characteristic(s) they thought might be missing from the list. The nine characteristics were drawn by the researcher from the research literature, Texas' Master Mathematics Teacher Standards (Texas State Board for Educator Certification, 2002), particularly Standard IX, Mentoring and Leadership (Appendix A); and the National Council of Supervisors of Mathematics (NCSM, 2008) PRIME Leadership Framework (Appendix B). The dispositions were combined by the researcher into a framework of teacher leadership characteristics, to more closely identify them for inclusion in the interview and for her clearer understanding.

#### *Field notes*

Two separate sets of field notes were maintained by the researcher. One was that associated with the interviews, when body language (movements and postures), speech acts, environmental events related to the timing, location, and circumstances, and observer comments were recorded. Low-inference vocabulary, as suggested by

Carspecken (1996, p. 47), was used for these components. Much of this data was later incorporated into the interview transcriptions and were so noted as Observer Comments (OC) within brackets. This researcher identifies these field notes as *Interview Field Notes*.

The second set of field notes, drawn from observations of the MMT program, served as contextual background for the research site, the program, and its participants. These notes included both handwritten and typed observations recorded by the researcher during the 14 months she attended the program classes as an observer. Comments about the course activities and reactions thought significant by the researcher were part of these field notes, which the researcher termed *Contextual Field Notes*. Incorporated into the data were the participants' individual and group responses to assignments, activities, and discussions. These included classroom posters used during presentations; examples of homework and classroom assignments; the syllabi for the courses; on-line discussion threads about teaching and learning; and participants' reflections on video recordings of classroom instruction. Also included in this data are the participants' anonymous responses to a survey during the first semester of the program.

#### *MMT standards and relevant documents*

The ten Texas Master Mathematics Teacher Standards include five dealing with mathematics content involving number concepts, patterns and algebra, geometry and measurement, probability and statistics, and mathematics processes. The other standards had as their focuses: 1) effective instructional approaches for all ranges of student capabilities; 2) a positive learning environment that features high expectations and equity; 3) selection and construction of appropriate assessments to guide, monitor,



evaluate, and report student progress; 4) mentoring and leadership, which stress communication and collaboration, coaching of colleagues, providing professional development, and making instructional decisions based on data and research review; and 5) those aspects of mathematical perspectives involving the historical development of mathematical ideas, the structure and evolving nature of mathematics, and mathematics relationships with society. The researcher compared the characteristics contained in them (particularly, these last five) to the characteristics and dispositions the research literature reports important for the work of effective teacher leaders.

She also reviewed the MMT preparation materials included on the Texas Education Agency's website (Texas State Board for Educator Certification, 2010), and additional details about the MMT Grant Program contained in provisions effective February 10, 2010, in the state's §102.1013 of 35 TexReg 1204 (Texas Education Agency (TEA), 2010). The analysis compared characteristics identified in the MMT Standards and the research literature to teacher-leader characteristics the researcher found in these later two documents. This analysis was used to pinpoint dispositions the state policymakers considered important to mathematics teacher-leaders, their training, and their continued support and development, and was compared to writings of national policymakers in their PRIME Leadership Framework (NCSM, 2008) to identify common themes.

*Documents of the PRIME Leadership Framework principles and indicators*

The PRIME Leadership Framework was developed over two years by board members of the National Council of Supervisors of Mathematics in response to board and membership calls in 2006 for more clarity about mathematics teacher leadership roles in

the pursuit of a quality mathematics education for every child. This organization, created in 1968, initially with 35 leaders, now includes over 3,000 mathematics teacher leaders at all levels, including course-level leaders on campuses, campus and district instructional specialists and department chairs, state curriculum directors, school principals, district superintendents, and university teacher educators (NCSM, 2008, p. ix). The group continues to have an open membership policy and recognizes “the mathematics education leader must believe it is possible to create school mathematics programs that are both equitable and excellent, and then take action to implement access to those programs” (p. 1).

The framework (Appendix B) is based upon a vision of improved mathematics teaching and learning and focuses on equity leadership, teaching and learning leadership, curriculum leadership, and assessment leadership. The researcher, familiar with the framework because of membership in the organization, learned more about it during professional development sessions provided at the Fall 2009 and Spring 2010 meetings of the Texas Association of Supervisors of Mathematics (TASM). Her notes and the handouts from that training, as well as more recent trainings provided by a service center of the state agency, added to her understanding of the development, purpose, and possible uses of the framework. Common leadership characteristics from the framework, the state standards, and research literature provided guidance for the researcher in the development of her questions for her interview protocol and later analysis of responses and other contextual information gathered over a year of observation of the MMT program. In turn, the nine identified characteristics were initial sorting categories for all data gathered during the study.

## **Procedures and Instrumentation**

All program members were invited to participate in the research during a 15-minute meeting following two of their classroom sessions. The recruitment script and information that was provided to the possible subjects is included in Appendix F, Recruitment Script. Willing participants were asked to complete and return the Consent Form, Appendix G, expeditiously so that interviews could be conducted in a timely manner. Interviews were scheduled during a three-week window in late Summer and early Fall 2010 in locations convenient to the study participants. Five participants willing to be part of the research study during that time frame were interviewed and their responses were grouped and reviewed based on their current classroom and leadership roles and experience. The data were subsequently compared to the leadership framework.

The researcher-participant interview protocol, Appendix D, contains nine semi-structured, open-ended questions, dealing primarily with teacher leader characteristics and dispositions drawn from the research literature and from standards of state and national policymakers, and with questions about the experiences of these emerging teacher leaders with peer teachers. All interviews (40-70 minutes in length) were conducted face-to-face. Immediately following the interview, time was allowed for any necessary follow-up questions for clarification and meaning checks, and for responses to questions from the participants. Each subject was provided a debriefing statement for signature, Appendix H.

The primary source of data in this study was the interviews whose protocols were generated from the leadership concepts embedded within the courses' topics of number

concepts, algebraic thinking, probability and statistics, and geometry and measurement. All the interviews were recorded, transcribed, and examined for accuracy by the researcher. The face-to-face interviews focused on the teacher leaders' subjective experiences and interpretations as they related to teacher leadership characteristics and dispositions (Jackson & Trochim, 2002). Participant responses shed light on this research inquiry. The data so collected built a picture of the emerging teacher leaders' understanding of the leadership construct during one early phase of their knowledge development.

Part of the thick contextual descriptive record consists of written notes of the interactions between participants and the instructors involved with the program, recorded during the researcher's observation of the weekly and bi-weekly classroom activities over a period of 14 months. Participants' written responses in on-line discussion threads and artifacts produced during the coursework were also part of the background record. These records provided only contextual understanding, however, and are not part of the primary data, which came from the semi-structured interviews.

### **Data Analysis**

The responses of the five participants to the first eight questions of the interview protocol were initially analyzed for comments and statements indicating the perceptions of the characteristics and dispositions these emerging mathematics teacher leaders felt important to their present or future work with peer teachers. A matrix of leadership characteristics and interview responses on particular topics was created to look for themes, consistencies, and patterns in the responses, as well as comments that did not seem to match the noted dispositions. This preliminary reconstructive analysis of the

qualitative interview data focused on low-level coding, resulting in numerous comment categories, including the nine characteristics from the interview. Further examination concentrated again on the dialogical data, especially the variations, to determine where additional coding was necessary. Initial comments on data analyses are present in Appendix E.

The early primary record and its analysis as described above, as well as participants' responses to the final question about the described nine teacher leadership characteristics, were then studied to determine the alignment of the emerging teacher leader's perceptions first, to the state standards, and secondly, to the national teacher leadership framework.

### **Reliability and Validity**

Ethnographic research can approach the issues of reliability and validity by using Goetz and LeCompte's (1984) two types of reliability – external and internal. Freebody (2003, p. 77) describes external reliability as “the extent to which independent researchers working in the same or similar context would obtain consistent results.”

Internal reliability concerns consistency in matching data and constructs by those researchers interested in the same situations and data. Internal reliability is improved by using multiple data-collection procedures -- observation, interviews, site documents, and other supporting sources (such as syllabi, project descriptions, and program standards). If the data collected is of sufficient quality and quantity, the research interpretations and conclusions will provide internal reliability.

To ensure credibility and trustworthiness, the researcher used peer debriefing, triangulation of data, and member checking. In peer debriefing, the researcher discusses

the investigation with someone outside the study. Lincoln and Guba (1985) describe it as “a process of exposing oneself to a disinterested peer . . . for the purpose of exploring aspects of the inquiry that might otherwise remain implicit within the inquirer’s mind” (p. 308). The peer debriefer for this study has over 20 years of experience teaching mathematics in public school systems, has served as both a campus and district mathematics teacher leader, and recently retired as district mathematics administrator supervising mathematics teachers and mathematics teacher leaders. Her knowledge of mathematics teaching issues and emerging mathematics teacher leaders ensured the researcher paid careful attention to the study’s process and direction, and recognized any emerging issues.

Using multiple and different sources of information, as well as participants from varying levels of teaching and leading experience, provided opportunity for the triangulation of data. Wiersma (1995, p. 264) describes triangulation as “a search for convergence of the information on a common finding or concept.” Denzin and Lincoln (1994) elaborate:

. . . triangulation . . . reflects an attempt to secure an in-depth understanding of the phenomenon in question. Objective reality can never be captured. Triangulation is not a tool or strategy of validation, but an alternative to validation (p. 2).

Each interviewee had the opportunity to review the written transcript of their comments and the characteristics list and definitions, but not the researcher’s interpretation of their remarks, nor the conclusions reached in the study. This may be seen as a limitation of the study. Lincoln and Guba (1985) describe the critical need for member-checking:

The member check, whereby data, analytic categories, interpretations, and conclusions are tested with members of those stakeholding groups from whom the data was originally collected, is the most crucial technique for establishing credibility (p. 314).

### **Limitations of the Study**

Several limitations related to the study's research design affected the findings and therefore data analysis. The timing of the interview phase and access to potential participants was limited. The interviews occurred between the end of summer university studies and the beginning of the school year for all of the program's 17-member cohort. This resulted in only five study participants. Several others wanted to participate, but had family and school professional development commitments that limited their availability during the three-week interview window. Even the five study participants initially struggled to find the interview time necessary that met the researcher's schedule. This impinged on the sample size which constrains generalizability of the study's findings.

Another design limitation was related to the Interview Protocol (Appendix D). Because of the wide variety of mentoring situations the participants found themselves in during their early educational career, an additional question or two related to the participants' understanding of the term mentoring would have aided the analysis. The participants included both those who have only been teachers and informal teacher-leaders and those in leadership positions who have been mentored as teachers and as leaders (both formally and informally). Their mentor/mentee situations seemed wide-ranging and clarifying questions would have provided additional depth to the collected data. Likewise, additional follow-up questions related to the nine characteristics listed in

the final interview question would have provided additional details of the participants' understanding of leadership dispositions terminology.

It is anticipated that the researcher's passive, prolonged observation during instructional sessions (in her role as one of the program evaluators) was as unobtrusive as possible to minimize any effects on participants and their responses during the project. However, the researcher recognizes her familiarity as one of the program evaluators may be seen as a limitation in that it could have influenced the participants' willingness to be part of the study. Long-term observations, called "prolonged engagement" by Lincoln and Guba (1985), should have reduced Hawthorn effects during the interviews, which occurred outside of the instructional context at a time and place convenient to participants. Carspecken (1996) also notes the need to reduce Hawthorn effect and its complication effect on data analysis, especially during the first stage of research (p. 89), which for this research was the primary research data collected from the semi-structured interviews.

The individual and particular personal and professional contexts of the participants may influence their perceptions and responses during the interviews. The participants (at various stages of pedagogical and leadership abilities and roles) are drawn from a variety of large urban/suburban school districts and private schools within a single large metropolitan area in southwestern United States. The researcher serves as a district level developer of teacher leaders in a public school district which is a part of this same area. Her work and her lived experiences may have influenced the direction and tone of the interview questioning and analyses. Although the researcher used care in the collection and analyses of data, her own lenses may have focused attention to certain



details during the interview protocol preparation or to certain comments from the participants during the interview data collection process.

## **CHAPTER FOUR**

### **FINDINGS: PERCEPTIONS OF EMERGING MATHEMATICS TEACHER LEADERS**

This study researched the perceptions of emerging mathematics middle school teacher leaders about those characteristics and dispositions they thought important to their current and future work with peer teachers in school-based mentoring and coaching assignments. The research also investigated how these perceptions were aligned to the standards and framework of state and national policymakers. In an effort to investigate these areas, a series of interview questions first probed the five participants about their experiences as new teachers, about professional development opportunities, and about their interactions with peer teachers and teacher leaders during mentoring and coaching situations. These questions about their beginning educational careers also centered on their understandings of the positive and negative aspects of the interactions and how the attributes of the campus and the involved teacher leaders affected their reactions.

Several questions addressed their own later participation as formal or informal mentors to student teachers, new teachers, and struggling teachers; and several dealt with what they thought were their teaching strengths or was an area they thought needed improvement. The last question asked them to assign points to rank nine characteristics or dispositions as to their importance in their future work as mathematics teacher leaders. These included those singled out by the State of Texas and national policymakers (National Council of Supervisors of Mathematics) as important and incorporated into mathematics teacher leader standards and the later group's leadership framework. The

dispositions included the following, which are defined in the interview protocol (Appendix D): Approachable, assessment-focused, collaborative, competent, credible, curriculum-focused, equitable, reflective, and research-focused.

Participant comments focused on several categories of early career experiences were sorted and summarized in side-by-side charts to facilitate analyses of patterns and discrepancies. These charts are included in Appendix E, *Participant Analyses*. Common patterns and some discrepancies were found in the participants' perceptions and understanding of the leadership construct when the researcher compared their comments about early career experiences.

This chapter first reports the participants' perceptions about leadership characteristics, including how both formal and informal mentoring experiences informed their perceptions.

### **Participants' Perceptions about Leadership Characteristics**

The characteristics of teachers and teacher leaders that the participants consistently indicated were important, by either assigning high value to their ranking or during the interview comments, included those that highlighted lifelong learning, self-reflection, collaboration, approachability, and relational capacity. The study findings about these characteristics and others thought important are discussed in this section. The ranking scores for each of the five participants are listed in Figure 2, *Participant Characteristics Perceptions*, shown below. Lucy and Donna also ranked the dispositions "equitable" as very important. Lucy and Fran gave high points to research-focused; Tomas noted credible and competent; and Lucy highly ranked assessment-focused. The five participants stated that all of the nine characteristics identified by the researcher were

important to mathematics teacher leaders, but possibly at different times in one's career and in particular situations. The points assigned, and their comments during that portion of the interview, reflect these perception differences.

**Figure 2. PARTICIPANT CHARACTERISTICS PERCEPTIONS**

<b>Participant</b>	<b>Description</b>	<b>Tenure</b>	<b>Points Assigned</b>
Donna	White female	Teacher: 9 yrs. Leader: 0	Equitable: 20 Approachable: 15 Assessment-focused: 15 Competent: 10 Credible: 10 Curriculum-focused: 10 Reflective: 10 Collaborative: 5 Research-focused: 5
Fran	White female	Teacher: 7 yrs. Leader: 2 yrs.	Approachable: 15 Collaborative: 15 Reflective: 15 Research-focused: 15 Assessment-focused: 8 Competent: 8 Credible: 8 Curriculum-focused: 8 Equitable: 8
James	Black male	Teacher: 8 yrs. Leader: 1 yr.	Approachable: 15 Collaborative: 15 Assessment-focused: 10 Competent: 10 Credible: 10 Curriculum-focused: 10 Equitable: 10 Reflective: 10 Research-focused: 10
Lucy	White female	Teacher: 3 yrs. Leader: 0	Assessment-focused: 15 Collaborative: 15 Equitable: 15 Research-focused: 15 Approachable: 10 Curriculum-focused: 10 Reflective: 10 Competent: 5 Credible: 5
Tomas	Hispanic male	Teacher: 3 yrs. Leader: 0	Approachable: 15 Competent: 15 Credible: 15 Reflective: 15 Assessment-focused: 10 Collaborative: 10 Equitable: 10 Curriculum-focused: 5 Research-focused: 5

### *Lifelong Learning*

None of the participants noted additional characteristics when asked to do so, but the interview responses of Fran and James indicated a commonality that they valued those dispositions that encouraged lifelong learning. Fran said, “I’m a lifelong learner . . . as I learn different things . . . I incorporate those really effectively, fairly quickly.” In describing lifelong learning, James added that it means to always “have your thinking cap on . . . you are always going to try and learn something to become a better educator.” Both commented about the importance of on-going professional and personal development in their work with peers, students, administrators, parents, and the community. Fran described her excitement about returning to the classroom this school year after two years as a campus specialist, “. . . stepping out of the classroom two years and being able to do as much professional development as I did . . . I am going to rock this year.” James, in a discussion about attributes of his campus that contributed to the positive experience of his own professional and personal development, credits the variety of teachers’ expertise on his campus and the fact that

. . .there is not a person I cannot bounce ideas off. . . These are the types of people that help you . . . They help other teachers on their team who may not yet be at that [their] particular level.

Participant Fran’s comments captured a summary of what the researcher found from an analysis of her and James’ early mentoring experiences:

We were doing things with the kids that were really kind of out of the box. So for me to be able to experience that in Year One kind of set the tone for my career, which was very beneficial. . . . I’m a lifelong learner. . . . I reflect a lot

on . . . practice . . . and really try to incorporate new technologies, new ways of teaching.

### *Characteristics Reflective and Collaborative*

Consistent with this notion of lifelong learning was that all of the study participants saw the value of reflection and collaboration in their early instructional career for the purpose of developing professional insight about their own work. For the teachers reflection meant individual consideration of one's practice, knowledge, and behaviors with a goal of improving instruction and collaboration meant that teachers and teacher teams were reflective practitioners who built trust and a collaborative spirit with other community members to improve teaching and learning.

Fran, Lucy, and James seemed to also recognize their role in developing reflective and collaborative potential in those they mentored. As noted previously, Fran saw her mentor's encouragement of reflection as setting "the tone for my career." Lucy talked about her planning work with a team at the beginning of instructional units and "that people like to come plan with me. . . .It is better to create a better, nicer work environment than [one where] people become negative . . . or isolated." James in a discussion of mentoring and coaching struggling teachers said that:

You can be very self-reflective about yourself. But, if you are not able to convey that to the people around you, or the teachers you are. . . helping, then there is not transfer....We want to be on the same level together.. . . where you can have those sometimes tough conversations . . . with the people you spend the majority of the day with. Period.

These three participants received continuous support from their campus and school districts in both formal and informal ways and in different modalities: time to reflect individually, time to reflect with another teacher, time to reflect with small teacher teams, and time to reflect in larger groups. Lucy participated in weekly collaborative sessions with other campus mathematics teachers discussing teaching and instructional practices and learning from both experts and fellow novices in the educational community. As a campus instructional specialist, James received regular feedback and time for dialogue, discussion, and reflection about issues he was facing in his work with teachers on his campus. Fran was mentored by a variety of educational leaders and in a variety of ways and commented, “If we are not reflecting, we run the risk of doing those ‘fluff’ lessons that are really fun, but maybe not really effective.” All three expressed their appreciation of campus and district administrative support, in addition to help from peer teachers. Lucy, in discussing her weekly sessions, noted “. . . all the people are always there – principal, assistant principal. It just keeps everybody on the same page. . . you quit isolating yourself.” James noted the support he and others received from the campus administrators,

I think just that support from administration . . . helps (new) teachers understand the atmosphere of the school and teach(es) them how to stay away from certain areas. Kind of focus on what you need to focus on . . . because your ultimate goal is to become the most efficient educator you can be.

There was no evidence from Tomas about being provided opportunities to dialogue about, reflect upon, and revise classroom instructional practices during mentoring or coaching interactions. Rather, he felt it was his responsibility “to



implement what the mentors tell me to do.” However, when commenting later on those leadership characteristics he thought important to his future work, he listed reflective first. He stated:

You need to be able to look at what you have done, so you can see how you can get better. It is through reflection that . . . you are able to fix problems that you might have.

Donna also indicated that there was little dialogue with other mathematics teachers during her first year of teaching. That first year Donna had no one with whom to collaborate and little time or encouragement to reflect on instructional practices. In her next position, she received reflective feedback about classroom practices from her mentor, but also direct instructions about what she should do. She recognized later that she was ill-prepared to mentor others possibly because of this early lack of collaborative and reflective experiences, and an uncertain understanding of the roles in mentor/mentee relationships. She lacked confidence in her ability to work with mentees on their classroom needs, focusing on providing guidance on campus policies and procedures instead. However, she stated she became more reflective about her own instructional practice. She described the experience as positive “in that I saw in her [the mentee] some of the things I should improve upon. . . . because I saw all the mistakes she made, I became more cognizant to watch for my own mistakes.” She ranked what she perceived as collaborative in the lowest group of characteristics important to future practice and reflection just above it in her rankings.

Additionally, Donna saw collaborative and reflective as paired and similar when she discussed characteristics important to being an effective middle school mathematics

teacher leader. Reflection, she noted, “is more individual reflection, where collaborative is more collaborative reflection,” or group reflection. James also saw collaboration and reflection as aligned: “Collaboration: You have to always be reflective on that point, because you are always reflecting with someone else or with a group of people.” One participant, Lucy, described collaboration as very important to a healthy and open work environment. She commented, “Even though you teach kids, you also work with adults.” She noted that weekly meetings with fellow teachers prevented teacher isolation, providing a consistent, expected time to reflect upon practice.

Both formal and informal mentoring situations informed the participants’ perceptions of characteristics of teacher leaders. These experiences are shared next.

#### *Mentoring Experiences in Formal and Informal Situations*

The mentoring and coaching experiences of the five participants were distinct from each other. They ranged from a first-year teacher receiving no identified support (Donna) to one continuing mentor/mentee relationship (Fran) and to several formal and informal mentoring and coaching situations (all). One pattern that emerged from the analysis was a relationship between the type and characteristics of the early mentoring experiences and how the emerging teacher leaders responded to mentoring others later, and how they viewed their communities of practice as novice educators. The analysis also revealed their understanding of characteristics held by their mentors in their early career experiences and those dispositions they felt could be useful to their own later teacher leader activities.

All of the participants reported that they were provided reflective feedback by mentors and peer teachers in their early careers. Those that received consistent, frequent,

and explicit experiences (James, Fran, and Lucy) valued their reflective and collaborative skills and indicated by comments they were comfortable in their ability to encourage and support reflection and collaboration in their mentees. Successful early mentoring experiences, in both formal and informal settings, set the tone for the careers of several of the other participants. If their own mentor/mentee relationship had been helpful and an important learning experience (Fran, James, and Lucy), it provided a role model for their future work as a teacher leader with new and struggling teachers, as well as with peer teachers and peer teacher leaders. As was reported earlier, Fran described it as setting a tone for lifelong learning. When there was no, or minimal, collaborative and reflective mentoring or coaching, the emerging teacher leader either struggled with the responsibilities and roles when assisting other educators (Donna), or focused solely on classroom management issues (Tomas).

As several participants moved from one educational setting to another early in their careers, the characteristics of their communities of practice changed and evolved, as did the mentor/mentee or coaching relationships and the support received from community members. Lucy and Tomas began to move into more informal coaching situations, both in giving and receiving guidance, and Fran and James stressed they saw themselves as “lifelong learners.” Fran received informal leadership coaching support from an interested campus administrator, who encouraged her to seek funds for special classroom projects from foundations and outside agencies. The same administrator and peer teachers steered this emerging teacher leader to a summer mathematics content and pedagogical workshop at a nearby university, which has evolved into long-term networking opportunities for the young leader. Later, Fran encouraged a struggling

member of her campus mathematics instructional team to attend the same workshop. James used his special education co-teaching assignments to widen his exposure to best practices in teaching and learning. In his wider community of practice, members included the school nurse, general and special education teachers, and more recently, other campus-based teacher leaders, who modeled how best to work with peer teachers as an instructional leader. He stressed the importance of building relationships and approaching mentoring from a position of competency.

Although a wide variety of circumstances presented challenges for all of these emerging teacher leaders, the researcher noted the value of both formal and informal mentoring. In both types of mentoring situations, those teacher leaders who were open to suggestions, to modeling of instructional and leadership practice, and to both individual and collaborative reflection about their instructional practice, seemed to understand the value of teacher leaders being competent, credible, and approachable, as described by Katzenmeyer and Moller (2001), as well as being collaborative and reflective. Both informal and formal situations provided supportive “learning laboratories” for these leadership dispositions. Ranking the characteristics competent and credible in his top grouping, Tomas explained,

You definitely have to be credible. . . I think as a teacher leader you have to be competent [and] credible. How often has it been that I have seen teachers where when you talk to them it is like smoke and mirrors.. . . You know you see teachers making comments during faculty meetings, like yes, it is for the students, yet it is all for them.. . . You have to be credible and really believable.

All of the participants experienced mentoring that was contextual and connected to their experiences – similar to characteristics suggested by NCTM in their view of student learning (Lappan and Briars, 1995; Mewborn, 2003). Donna and Tomas, however, indicated a lack of dialogue, discussion, and interaction, and did not seem actively involved in the adult learning process. Donna did not see any of her first year's interactions with peers as helpful and did not have an identified mentor. In a later assignment in a larger school district, she reported little dialogue and discussion with her department chairperson about how to work with struggling students. Rather than benefiting from reviewing, critiquing, and revising one another's work with lower-performing students, teachers on her campus were told what to do.

The comments of Tomas about his early experiences indicated his struggles with classroom management and the importance he placed on the perceptions of his students about his lack of experience and young age. However, he clearly felt supported in those early years of teaching, noting he would not still be a teacher after three years if it had not been for their guidance. He stated he appreciated their hearing his concerns and problems with students and that “first year teachers really only want someone who will listen and acknowledge that it is difficult.”

The five participants indicated early career needs in various instructional areas (curriculum, equitable classroom instruction, best practices, and classroom management) that require ongoing support from fellow teachers and teacher leaders. Those who had multiple situations providing mentoring where they thought they needed growth (James, Lucy, and Fran) seemed more comfortable later when mentoring teachers themselves. One participant (Fran) served as an instructional specialist on her campus for two years

with a primary role of mentoring struggling teacher by modeling classroom activities and best practices, both in curriculum and classroom management. Fran would then leave for several instructional periods, returning later to observe the teacher's implementation to provide feedback:

And, if I needed to teach again, then I could do that. If there were lessons that needed to be tweaked, we could do that. We could talk about that. . . . I have incorporated a lot of the things that my administrators have worked with me on [when] I was first teaching, and have tried to encourage teachers to go to different programs.

Fran acknowledged that it was difficult work and that as a mentor she attempted to inspire in these mentees the desire to seek professional development in areas where they needed growth.

All of the participants except one (Donna), found their informal and formal mentors to be approachable and supportive during their early careers. Donna, in her first year as an educator, was assigned to a campus team that included only one other teacher, a third-grade teacher who was not teaching the same fifth grade curriculum. This study participant was not encouraged to seek advice and felt unsupported, describing this first year as "very unsuccessful." In a later assignment in a larger school and district, the mentor on her campus was the mathematics department chairperson, who worked with all the teachers, including those with many years of teaching. A key characteristic of her later mentor was her high expectations for both students and teachers, highlighted in the equity principle of the leadership framework of the National Council of Mathematics Supervisors. Listing equitable at the top of her list of desirable characteristics of

emerging teacher leaders, Donna saw high merit in this disposition for educators.

Although Donna acknowledged it was important to have high expectations, she indicated some of its aspects may have not been well understood by her mentor who did not encourage reflection nor collaboration in her work with teachers. She instead issued a “proclamation” about how to improve student performance on state testing without discussion with the teacher teams:

She told us we needed to have these keywords on our wall this year. And I personally had an issue with keywords, because I think the kids need to understand the actual problem, not look for greater than, less than, add to. They need to look beyond these keywords. So I think she just threw this proclamation down, without actually ever discussing it with us.

Donna did not find this mentor competent in her pedagogical decisions for lower performing students because the mentor only taught advanced academics in mathematics to the middle school students, grades six through eight. That assignment indicated the mentor was certified to teach upper-level courses including high school calculus and was therefore competent in mathematics content knowledge, as defined by the state through its certification examination process. Donna commented that this mentor helped her develop sound mathematics lessons, and that there was little input from campus administrators in curriculum decisions, which she saw as good campus leadership. These experiences fostered development of an autonomous, self-directed and less collaborative approach to her career. This independent stance continues in her current assignment in a small private school where she is the only teacher in the computer science department.

Fran's mentor taught the same grade and same subject in a nearby classroom and was attentive to the needs of the young teacher. Here credibility, approachability, and the actual physical proximity of her mentor supported her leadership growth and Fran was quite comfortable mentoring other teachers later and displayed characteristics similar to her mentor. Her early mentor and she continue their relationship in an informal way now that Fran is working in another nearby school district.

Lucy's first-year mentor was not a peer teacher but a campus-based instructional specialist who spent the first week of school helping her set up her classroom and establish routines and student expectations. She noted the mentor was both approachable and timely with advice. Lucy saw her as both credible and competent, particularly because of her attributes of being attentive and organized -- traits that Lucy herself displayed in her own work with a grade level mathematics/science teacher team later. This mentor, as well as the instructional specialist on her current campus, generally were able, she noted, to provide immediate feedback, "They're easy to talk to. . . they usually have lots of things to offer right away, without saying, 'come back.'" As her career progressed, Lucy sought the advice of peer teachers on her campus with more experience or with creative ideas, indicating that they provided curriculum ideas and shared readily.

James stressed the importance of mentors being credible, competent, collaborative, and approachable, in his own work as a campus specialist. He delayed moving into his current position until he felt competent in the vertical connections between early childhood mathematics learning and upper grade (4<sup>th</sup> grade) mathematics. James did not directly address the characteristics of one, formal mentor, but described his mentoring as on-going and involving opportunities to watch multiple teachers to learn



about “their teaching styles and strategies used and their attitudes in teaching mathematics to kids.”

There were positive aspects to all the participants’ early experiences and support as teachers, although they differed in details, duration, and the direction of the interactions. For some participants, observations were primarily one-way, where the emerging leaders were observed by others, usually an administrator or mentor, during classroom instruction. Other participants were involved in multiple observations of best practices modeled by fellow teachers or campus instructional specialists.

Three (Fran, James, and Lucy) discussed multiple two-way classroom visits, supported by campus administrators, where they visited peer teachers’ classrooms, and with other teachers observed another’s instructional practice. The use of activities that involve multiple observations or classroom walkthroughs with a group of teachers was an option that Lucy particularly thought helpful to her and other teachers on her campus. She lamented that the group walkthroughs only occurred twice and thought her fellow teacher team members would have further benefitted if the visitations had become a routine built into their schedules.

Fran, James, and Lucy particularly noted the positive effects they received from being able to view and examine the contextual work of peer teachers and in turn to be observed by others, whether in co-teaching situations, during planned walkthroughs with others, or when allowed to observe their mentors. Tomas did not mention any such experiences and Donna only addressed one-way observations where her mentor gave reflective feedback on Donna’s instructional practice and one-way observations of her

mentee. This directional aspect of campus and classroom observations may play a role in the development of teacher leader dispositions.

Those who had multiple, varied, and frequent observation opportunities showed evidence of strong support for using reflective thinking in collaborative teams on their campuses. Such reflective conversations expanded the dialogue about teaching and learning within the community of learners and encourage the self-monitoring of their professional growth. Two participants who were involved primarily in one-way observations either felt uncomfortable as a later mentor (Donna) or had not yet been asked to formally mentor another teacher (Tomas). Tomas served in informal roles with peer teachers, retelling a first-year narrative about repeated thoughts of leaving teaching. Tomas never discussed whether he had observed the classroom activities of another teacher or had reflective coaching conversations about what he saw during instruction. Donna felt shy and uncomfortable about making suggestions for another's practice even though she was a new teacher's official mentor. Donna did not understand that most reflective feedback is non-judgmental and non-prescriptive. Its purpose is to build trusting relationships and expand the ability of teachers to "think about their thinking," and to individually or collectively analyze their actions, beliefs, and emotions.

#### *Early Career Experiences and Leadership Perceptions*

Most of the study participants described several positive aspects of mentoring and coaching during the first year of their educational careers, which seemed to clarify their perceptions of characteristics important to the work of teacher leaders, including their own future work as school-based specialists. One of the participants did not report positive mentoring experiences during her first year. As discussed previously, Donna

moved in her second year of teaching to another school where she felt more comfortable with the support received. That situation included her mentor providing reflective feedback after observing Donna teach. James was most appreciative of the support he now receives as an emerging teacher leader in networking groups with other instructional specialists. Fran and Lucy indicated that opportunities to watch their mentors and others during classroom instruction were positive experiences. Tomas noted he appreciated his mentor(s) helping him with classroom management, with how to teach and monitor student progress, and with how to pace lessons.

Fran and Lucy addressed the importance of mentors' approachability and their readily answering questions about curriculum and activities. They both appreciated being provided access to materials and ideas, particularly mathematics manipulatives and classroom supplies. More importantly, they valued the time mentors took out of their own day to talk to them and that their campus administrators encouraged these interactions, providing new teachers time to visit and observe their peers. Fran explained, "[my mentor] was really there, just as a leader from the side," and she had many opportunities to watch the advisor teach. The campus administrator provided this learning situation by offering a substitute teacher for Fran's class, or stepping in herself to monitor the students while Fran visited her mentor's classroom. Lucy had some initial modeling of lessons by the instructional specialists assigned to her two campuses. However, watching peer teachers later with other teachers during conference times "was good. . . to see other people, hear what they say, hear how they say it."

Donna appreciated the very direct guidance she received from her mentors, noting her mentor was "proactive in helping me develop math curriculum." She added,

She really didn't have a lot of fluff. She told you straightforward, which I really appreciated. Some people thought she was a little harsh, but I liked that. I liked that she would just say that I need to do this, I need to do that.

In describing her teaching strengths, Donna indicated her perception of the value of teacher leaders being curriculum-focused,

I want them to feel comfortable in math. . . I always try to encourage them to try something even if they are making mistakes. . . I'm always trying to bring in meaningful activities – problems that might be beyond their reach, so they're constantly being challenged. . . . I try to do that rather than, "Here is the algorithm, so copy this ten times."

Tomas noted that although he did not need much help in curriculum as he already had a semester teaching as a long-term substitute teacher in the same class, at the same grade level, and with the same textbook, he valued the mentor support:

I didn't need much help on that front . . . I am very happy with what they have done for me. Otherwise, I would not be sitting here. . . . I wanted to quit by September. I survived until December, but in January I still wanted to quit. For some reason I managed to survive until May. I finished my first full year, thanks to my mentors, who were there to lend an ear if I had some sort of complaint or any hardship.

He also described a one semester stint of teaching advanced 8<sup>th</sup> graders in Algebra I as a "breath of fresh air," and "really teaching." The end of this short-lived assignment probably resulted from the district's realization that those teachers on that campus teaching Algebra I to 8<sup>th</sup> graders without the appropriate state mathematics content

certification (through Grade 12) lacked the required “highly qualified teaching” status as defined by the federal government.

All of the participants have attended outside professional development, although most addressed the fiscal constraints their campuses and districts have faced in recent years. Donna said that special workshops were encouraged, and in some cases expected, but that it seemed unfair for those who could not afford travel expenses associated with them. She did praise the fact that those who attended were encouraged by administrators to share what they learned during the summer workshops with colleagues in the fall. Most of the trainings on her current campus are now provided by campus-based personnel.

Lucy’s professional growth opportunities mirrors those frequently encountered today by nascent teachers. She has attended outside workshops, but most of her training involves staff developers brought into the district for all teachers in a particular discipline while students are not in classes. However, she indicated that she particularly prized the campus-based professional development where she met with fellow teachers in weekly sessions to discuss and view instruction. Fran felt empowered by outside trainings she described as “life changing,” in that the staff developers increased both her content and pedagogical content knowledge. The sessions also continue to provide opportunities for networking with teachers throughout her metropolitan area. James has attended some outside and district trainings, but particularly benefited, he felt from the day-to-day exposure to good instruction.

Tomas attended a highly respected classroom management training focused on developing relationships with students, but indicated an inability to yet implement some

of their suggestions, including daily classroom greetings, because of campus systemic issues. He has been assigned duty between classes in another part of the building to ensure that the paths of 7<sup>th</sup> graders do not cross those of 8<sup>th</sup> graders and is not always present to individually greet each of his own students as they enter the classroom.

The experiences of the five participants presented differing negative aspects, often prompted by their particular mentoring and support situations and personalities. Donna found her mentor suggesting strategies for low-performing students counter to what she herself felt best; Fran, although grateful for the support she received, was quite uncomfortable because her first-year mentor received a lower evaluative summary than she did. James, while voicing that he had a lot to learn, described his mentoring and coaching as all positive. Lucy felt constrained mainly by lack of time and physical things (availability of manipulatives) in the classroom as it was not always factored into the changes she wanted to make to improve instruction. Tomas acknowledged he learned from a very bad start and implementing suggestions was up to him. He learned that teaching was not an easy endeavor.

James felt comfortable with the mentoring he received as he observed multiple classrooms. Yet before he would accept a position as a math coach or instructional specialist on his campus, he waited several years to ensure he was competent in mathematics instruction for those lower grades to which he had not yet been exposed. His reluctance to pursue an earlier advancement in his career indicated the value he placed on the leadership characteristics competent and curriculum-based as described in the interview protocol. Fran was quite confident that her mentor(s) had prepared her to confront important teacher, classroom, and campus issues.

*Perceptions about Relational Capacity and the Characteristic Approachable*

James prized the understanding he acquired from his peer teachers and coaches of the importance of relationships and the perspective good relationships provide. His special education positions, whether co-teaching with others or working with individual students, provided him an understanding of the significance of relationships in teaching and learning. He commented, “It definitely gives you the other perspective to think about when you are working with teachers.” He added that just coming out of a teaching position helped him:

. . . understand how those relationships are so important and how they have a direct impact on the growth of teachers. . . . how the same thing applies between teacher, specialist, and administrator....[you can provide] quality information, but if the environment is not right, or the relationship is not right, it still might not be taken into account.

Tomas saw his mentors as approachable, when he addressed their willingness to hear his concerns. He also listed relational capacity and the disposition approachable as important for educators in their work with students and peers:

Being able to get myself into the shoes of my students and being able to relate to them is another strength, I think. . . . You have to be approachable. You know teachers can’t be thinking, “Okay, that person looks mean, and I don’t think that person is going to talk to me.” . . . to your fellow co-workers, your colleagues, your students, I think approachability is a big thing.

Tomas did not see the attribute approachable as similarly important for administrators to perceive in teachers or teacher leaders, noting administrators are “higher ranking per se” and will approach you because they “need to approach you.”

Lucy saw approachable as tied to collaborative, and important:

Even though you teach kids, you also work with adults. . . It keeps everyone together . . . like you share your professional “nice.” And that way if you have questions you’re not nervous about it or thinking about it for five days before you go ask your question. . . knowing the right person to talk to.

Donna saw approachable as tied to all the rest of the characteristics and high on her list of desirable dispositions, “If you are not approachable then really the rest doesn’t matter, because no one wants to go, or feels like they can talk to them [teacher leaders].” She added that she also saw credible as aligned with approachable, “If you are not credible, I don’t really see you as approachable. I [must] believe what you say and you must do what you say.”

Fran highly prized approachable in the dispositions she said were important to the work of teacher leader. Without this characteristic, one would be unable to lead:

I think that is probably one of the number one things that’s needed. You have to be approachable to teachers, to other teachers on campus, not just teachers in your content area. Approachable to parents, kids. If parents feel that they can’t trust you, or can’t talk to you, then right there, right off the bat, that communication is not there, and you are not able to lead.

In describing her teaching strengths, Fran noted she was able to reach kids in ways that seemed difficult to explain to other teachers and said in describing those relationships



with students, “I don’t know if it is my personality, or just a patience that kids understand.”

### **Alignment of Teacher Leadership Understandings to Texas Standards**

Texas’ Master Mathematics Teacher Standard IX has at its core mentoring and leadership. Its description states:

The Master Mathematics Teacher facilitates appropriate standards-based mathematics instruction by communicating and collaborating with educational stake-holders; mentoring, coaching, exhibiting leadership, and consulting with colleagues; providing professional development opportunities for faculty; and making instructional decisions based on data and supported by evidence from research.

The study participants were in a state-approved program that prepares teacher leaders for certification as Master Mathematics Teachers. This standard requires their understanding their future role and the complexities of implementing school-based coaching programs on their campus or within their district. Its key components are communication and collaboration with fellow educational stakeholders, the effective application of mentoring, coaching, and consulting skills and strategies to facilitate development of a standards-based mathematics program, professional development that promotes and sustains positive change in instructional practices, and decision-making based on research evidence.

#### *Communication and Collaboration*

The perceptions and understandings of those participants (Fran, James, and Lucy) who have had multiple and frequent collaborative experiences seem aligned with the

communication and collaboration portion of the standard. They understood their role in assisting other teachers to reflect on teaching behaviors and develop reflective and collaborative potential, as discussed in the earlier section *Characteristics Reflective and Collaborative*. However, those who had limited opportunities for reflective discussions with peers (Tomas and Donna) do not yet have as clear an understanding of the roles collaboration, approachability, and credibility play in their work as future master mathematics teachers

This section of the standard also addresses the need to hold high expectations and ensure equity in mathematics instruction for all students. Two participants, Donna and Lucy, directly discussed equity in mathematics teaching and learning. Donna listed equitable as high on her list of desired leadership characteristics and campus attributes, noting that holding high expectations for all students as well as teachers was important. However, she was uncomfortable in feeling her mentor did not really understand the needs of struggling kids and how best to help them. In describing one of her strengths, Lucy talked about students and how she “make(s) them want to work;” and later elaborated about teacher leaders being equitable:

I think it is good, very important to encourage high expectations because I don't think the kids really know how good they can do. So if you keep your students at high, they only have to work high to feel they are successful [and] at their best. Meaningful for your students.

James and Fran, currently serving in leadership roles, did not directly address equity. However, the researcher relied on their comments about their experiences with all levels of students to determine their valuing equitable and having an understanding of equity as

detailed in this section of the standard. They also assigned points to the equitable characteristic in their ranking (as did all participants). James has been quite involved with special education students at all elementary grade levels and Fran discussed her ability to connect to struggling students that others could not reach. However, Fran lamented her inability to help other teachers make the same connections. Tomas has primarily taught struggling students, but his comments about how he felt he was “really teaching” when he had a one-semester assignment to an advanced Grade 8 class of Algebra I students indicated he may not yet have a clear understanding of equity:

I guess it was a breath of fresh air. You get – really get – to teach, in the sense of teaching in the algebra class. . . . In the sense of actual teaching I felt like a teacher in that class because I really get to teach math, which is what I really like to do to begin with.

### *Mentoring, Coaching, and Consultation*

This section of the standard addresses the effective skills and strategies of mentoring and coaching needed to improve mathematics instruction for all students and all colleagues. It focuses on the development, implementation, and monitoring of instruction and the use of consultation to work effectively with the wide variety of skills, experiences, and philosophical approaches of colleagues. James, one of the two participants currently serving as a teacher leader, in his discussion of relationship building, spoke about peer teacher differences and how that affects his work with them,

And building those relationships. . . .I said before you always have to build those relationships with . . . those teachers throughout the year so that you know you are trying to help them grow educationally in the content area, as well as at

the same time personally.

James was looking forward to an even more successful school year because he felt he was in a better position to speak to teachers because of those relationships, “I can have those conversations – [that were ] maybe before difficult conversations. I can have difficult conversations about their instruction and how it impacts their kids without appearing threatening.” The other campus teacher leader, Fran, indicated that for the past two years her job was to mentor struggling teachers. When she saw a teacher doing a job well she would encourage other teacher on the campus to observe that teacher, “so they could get the same thing I was getting on a daily basis.”

All study participants appeared to appreciate and understand the mentoring and coaching portions of the standard, evident from their discussions of the negative and positive aspects of their early career experiences, but several have not yet had any guided practice with the skills and strategies needed to give reflective feedback or have productive consultation with peer teachers. Without this rehearsal and exercise, the approaches of Tomas and Donna to peer teachers seemed awkward and non-productive. They may also have hesitated to provide the needed support that mentoring, coaching, and consulting offers, as occurred with Donna in her mentoring experience with a new teacher.

### *Professional Development for Faculty*

The emerging teacher leaders reflected on those learning processes and support they required for their own learning and professional development and discussed those in their interview comments. For most of the participants, the models and features of their learning illustrated effective processes and procedures that facilitated adult learning,

including demonstration, modeling, feedback, coaching, and follow-up. Unique to the challenge of their providing professional development for struggling or novice teachers, emerging leaders will need an understanding of what works for adult learners, what strategies provide effective professional development for struggling teachers, and what to do to follow-up interventions designed to promote and sustain positive change in the mathematics program. The major evidence they showed in this area dealt with school-based support of their own early educational career and their informal and formal work with other teachers. This included reflective and collaborative aspects of their mentoring, described above, and for current teacher leaders, their modeling of instruction for new and struggling teachers. No discussion of how the teacher leaders developed and provided other types of staff development for teachers on their campus occurred, so it could not be determined if any of them have experience in providing professional development in formats other than as a school-based teacher leader providing mentoring and coaching support to individual peer teachers or small teams of fellow teachers.

#### *Decision Making Based on Evidence from Research*

All of the participants saw the value of making instructional decisions based on data and research findings suggested by this standard. Data use by all educational stakeholders has expanded as districts and campuses attempt to resolve instructional dilemmas focused on certain sub-groups on their campuses (like racial, special needs, and socio-economic standing). Most of the participants commented that using evidence from research when making classroom decisions about teaching and learning is difficult. Some struggled also with how best to implement research findings (Lucy and Tomas) and

one (Tomas) commented that sometimes the research does not seem to match their own classrooms.

James generalized the whole philosophy of special education to the rest of education, stating “You’re tracking data. You’re tracking information to check on progress.” He characterized his transition from classroom teacher to campus teacher leader as an easier one because of his experience with data. On the use of research-based instructional strategies, Lucy commented on a workshop she attended that focused on movement in the classroom:

After going to things and just sitting there is hard even for adults to do....Have to remember that for kids even though in your mind you have so much to teach them, or want them to learn.

Tomas expressed the difficulty of using research-based activities to inform instruction. He commented on the use of possibly unsupportive videotapes of other teachers and found that some classrooms featured may not have had attributes similar to his own classroom,

. . . seems like that research is based on an ideal classroom. . . . I am the kind of teacher that says, “that doesn’t look anything close to the classroom I have.” . . .

So does that research really transfer to my classroom?

### **Alignment of Teacher Leadership**

#### **Perceptions with the PRIME Leadership Framework**

The PRIME Leadership Framework of the National Council of Supervisors of Mathematics (NCSM, 2008) focused on four principles and indicators of their use by mathematics teacher leaders. The principles included leadership in the areas of equity,

teaching and learning, curriculum, and assessment. The national organization listed indicators of these leadership characteristics in their framework, which is detailed in Appendix A, *The PRIME Leadership Framework*. Many of these principles and indicators are aligned with the mentoring and leadership standard (Standard IX) for Texas Master Mathematics Teachers.

### *Equity Leadership Principle*

Indicators for the application and implementation of the equity standard focuses on teachers possessing, and teacher leaders fostering, high expectations for students, ensuring appropriate interventions and support for each student, and providing continuous improvement in each student's achievement. Fran, James, Lucy, and Tomas exhibited an understanding of these attributes in their work with struggling students. In an earlier teaching assignment, Donna indicated her concerns about what was appropriate for struggling students in a large suburban school. Now, Donna is in a unique private school situation, yet she also recognized the importance of providing a rigorous and coherent curriculum that holds high expectations, listing equitable high on her list of desired leadership characteristics and campus attributes.

Only James noted his use of data to make decisions about individual students, focusing on his special education background. Although summative assessment results were also briefly addressed by all of the participants, the other four did not discuss how data was used to ensure that underperforming student populations were identified and provided strategic instructional strategies to raise their achievement. Although, Tomas was assigned to teach students who had failed the previous year's exam and were identified as at risk of failing that year, he said, "any success was a big growth for us. . .

any improvement is definitely welcome.” He did not indicate whether he focused on particular student weaknesses or used assessment data to make instructional decisions for his struggling students.

The organization also recognizes that it is up to teacher leaders to ensure classroom teachers create environments that place a high value and encourage student discourse. Several of the participants focused on student discourse during their interview. Donna noted that by showing and developing respect with the students, dialogue is created:

You ask questions, you let them ask questions, rather than just answering their questions, or throwing questions at them. It’s got to be a two-way street. . . .a dialogue in the classroom. Not just delivery of content, and then you do the work. I mean I want feedback from them. Then keep it very conversational in my classroom.

Lucy noted that she built good relationships with students and gave positive feedback, as “They feel very okay to raise their hand or say something.”

### *Teaching and Learning Leadership Principle*

This principle focuses on ensuring high expectations and the use of meaningful mathematics instruction every day. Its indicators include the pursuit of successful mathematics learning by every student, classroom implementation of research-informed best practices and effective planning and teaching strategies, and teacher participation in on-going and meaningful professional development to improve practice. This teaching and learning indicator addresses the need to use strategies to support learning of all students, including those students in need of additional support to succeed in



mathematics. At some point in their careers, all of the participants have been involved with students needing additional support for success in mathematics. Some of their discussion about this is in earlier portions of this chapter.

Lucy talked about implementation of research-informed practices involving the use of movement in the classroom and thought training on it was meaningful for her classroom practice. Tomas struggled with justifying implementation of practices that were part of video professional development training he attended because he did not feel comfortable in doing so. He challenged whether his classroom was anywhere close to the classroom illustrated. Fran was cautious in her discussion of research, stating that if you are research-based, you will be credible in your teacher learner relationships. She indicated concern that sometimes what appears to be credible is actually several layers of fun, stating,

I've met teachers that seem credible, but when you peel back the layers, they're more fun than credible. You know, the kids are responsive to them because of their personality. But, in actuality, the mathematics being taught is really not effective.

### *Curriculum Leadership Principle*

This principle supports ensuring relevant and meaningful mathematics is part of every lesson for every student. Some of the important foci for teachers and teacher leaders about this principle include implementation of a curriculum that is focused on relevant and meaningful mathematics, that all students attain the intended curriculum, and that every teacher implements the intended curriculum using instructional resources that reflect state standards.

Lucy and Fran addressed this principle in their discussions of relevant and meaningful activities. Lucy explained that her lessons were “ever changing,” Fran said, “I want the kids to understand where the mathematics is applied. . . so my students don’t leave my class wondering ‘When am I going to use this?’ They know.” James and Tomas did not address the need for meaningful activities during instruction. Tomas, however, stated he did not agree with the school district’s required scope and sequence and basically ignored it after the first semester in his first year of teaching in his current district. His understanding of the district’s scope and sequence did not follow the adopted and issued textbook and it presented certain fraction operation instruction in an order which he did not support. Donna noted that one of her strengths was her efforts to bring in “meaningful activities,” as discussed previously.

The Curriculum Leadership principle of the PRIME leadership framework also addresses the need for all teachers to implement intended or local curriculum which reflects state standards and national curriculum recommendations. Only Tomas indicated he did not use the local district’s curriculum, stating that he did not agree with its sequence of instruction.

#### *Assessment Leadership Principle*

The link between equity leadership and assessment leadership was not addressed by these emerging teacher leaders and possibly their connection is not clearly understood by them and others in the mathematics community, especially by nascent teacher leaders. One PRIME framework indicator under assessment leadership is that teachers use assessments that are common or congruent, and aligned by grade level or course content. A PRIME indicator of equity leadership prompts teachers to work interdependently in a

collaborative learning community to create equity in student learning. This means teachers develop lessons and activities that implement and monitor the learning process to ensure that all campus assessments are fair and free of bias. Without common assessments and without common grading policies agreed upon by collaborative teacher teams, teachers and teacher leaders may find it difficult to achieve equity in this area.

### **Summary of the Findings**

Teacher and teacher leader characteristics the participants thought would be important to their future work with peer teachers emerged from the data of the teachers' characteristic ranking and from their comments during the interview process. All nine of the characteristics were thought important by these emerging teacher leaders, but possibly at different times during a teacher leaders' career or in specific situations that required their use. However, several were seen as key characteristics that were required for most of their work. These included approachable, collaborative, equitable, and reflective. Perceptions, understanding, and thus alignment to the standards and the PRIME framework, were affected by formal and informal mentoring experiences, the types of participant observations, opportunities for reflection and collaboration, and other early career activities and professional development.

## CHAPTER FIVE

### DISCUSSION, CONCLUSIONS, RECOMMENDATIONS

Content, pedagogical content, curricular and contextual knowledges, and leadership dispositions impact the effectiveness of the work of school-based mathematics teacher leaders. Because teachers and teacher leaders use these understanding and skills to filter the construction of new knowledge, their perceptions of the value of leadership dispositions guides the use and practice of actively coaching, mentoring, and consulting with peer teachers within their campus “learning laboratory” (Cobb, Wood, & Yackel, 1990, p. 131). Leadership skills, attitudes, knowledge, and behaviors, including competency, credibility, and approachability (Katzenmeyer & Moller, 2001), and other dispositions that show a positive relationship to improved student learning and performance, are desired in teacher leaders, both experienced and nascent. Teacher leader characteristics that focus on learning by teacher leaders, teacher colleagues, and students promote and support changes in instructional practice to those aligned to the recommendations of the National Council of Teachers of Mathematics (NCTM, 2000).

Effective school-based staff development that encourages reform in mathematics classroom instructional practices called for by NCTM in its seminal *Principles and Standards for School Mathematics* (2000) will occur when teacher leaders are identified and supported in work with their peers on their respective campuses. Teaching and learning reforms occur when teachers are leaders both inside and outside the classroom (Ash & Pearsall, 2000) and when leadership is distributed throughout the campus organization with teachers collaborating with teacher peers and administrators

in decision making (Grogan & Roberson, 2002; Spillane, 2006; Urbanski & Nickolaou, 1997; Witcher, 2001). Collaborative reflective practice and analysis with colleagues or a new teacher was noted by Stigler & Hiebert (1999) as an often overlooked professional development opportunity in American public school systems. These active learning experiences with teaching peers from one's own campus can provide desired teacher and teacher leader characteristics that support student achievement (Desimone et al., 2002; Desimone et al., 2006).

The purpose of this study was to describe perceptions about leadership characteristics held by novice or emerging mathematics teacher leaders participating in a middle school master mathematics teacher (MMT) certification program in the state of Texas. The Texas Education Agency states the primary duties of an MMT are to teach mathematics and to serve as a mathematics teacher mentor to other teachers. Therefore these teacher leaders are preparing to serve as leaders both inside and outside of the classroom. One focus of the research was on the emerging teacher educators' descriptions of the construct of teacher leadership and its characteristics as they participated in a program preparing them for work with peer teachers on their campuses and within their school districts. A second focus was to understand their perceptions of the teacher leadership construct in terms of mathematics teacher leadership standards of the State of Texas and in terms of the nationally formulated PRIME Leadership Framework of the National Council of Supervisors of Mathematics (NCSM, 2008).

Because of the study's purpose, the research addressed the following research questions:

1) What characteristics and dispositions do emerging middle school mathematics teacher leaders perceive as important to their work with peer teachers in a school-based learning situation?

2) Based on these perceptions, how do the teachers interpret the State of Texas Master Mathematics Teacher Standards?

3) Based on these perceptions, how do the teachers understand the principles and indicators for mathematics educational leaders contained in the PRIME Leadership Framework of the National Council of Supervisors of Mathematics?

In the upcoming sections, the researcher will discuss several areas that arose from the findings, including the value of formal and informal mentoring, instructional observations, and the modeling of practice. Also included is a discussion of the teacher leaders' understanding of the leadership construct and how these align with the standards and framework of state and national mathematics leaders. Suggestions for teachers, teacher leaders, and administrators will be addressed. The role of campus and district administrators, as well as peer teachers, on the development of these teacher leaders may shed light on fostering and supporting future mathematics leaders.

### **Value of Both Formal and Informal Early Career Mentoring**

The significance of both formal and informal early career mentoring to the development of teacher and teacher leader characteristics important for their work as campus-based teacher leaders should not be overlooked. Mentoring and coaching early in one's career by all members of one's community of practice supports the retention of teachers and the types of practice sought in state and national standards and the changes necessary to ensure that all children are provided appropriate instruction at a high level.

Wong and Wong (1998) found that 95% of new teachers who received support during their initial years remained teaching after three years and 80% after five years.

Mentoring situations are successful when new teachers have common planning times with their mentors, teach the same subject, and are located near one another on the campus (Darling-Hammond, 2000; Johnson, 2004; Reiman & Thies-Sprinthall, 1998).

This early induction phase plays a critical role in shaping a new teacher's teaching practices and perceptions for the rest of his or her teaching life (Kuzmic, 1994). To be able to walk across the hall or next door during one's first year to see instruction that results in the student achievement sought develops trust in one's mentor and a commitment to fellow teachers and students on the campus (Ferguson, 2006), as occurred with several of the participants.

The interview discussions highlighted the importance of many types of mentoring and early career experiences focused on students and new teachers and suggested that frequency and variety of these situations may lead to the desired development of those teacher and teacher-leader characteristics that foster increased student and teacher learning. All participants experienced mentoring that was contextual and connected to their classroom. Several also reported that help and continued feedback from an administrator allowed them to develop skills in instructional and leadership practices, including coaching peer teachers and working with parents and students

School-based professional development that assists entry into the educational profession can enhance the characteristics that support student achievement, the ultimate goal of teacher learning opportunities. Sometimes this professional development is

provided by instructional facilitators, but input from both experts and novices within one's educational community of practice impacts this on-going professional learning.

The lack of frequent dialogue, discussion, and interaction early in one's teaching career can prevent active involvement in the adult learning process. Those who do not see interaction with peers as helpful, do not have an identified mentor, or do not have frequent collaborative dialogue with others centered on teaching and learning may develop characteristics that lead to a reliance on those elements of autonomy that foster isolation and the ignoring of collaborative practice. Those teachers who are told directly to "do this or that" instead of having some input during the process may see coaching and mentoring as micro-management and never appreciate the role of collaboration in on-going school-based professional development. Administrators and others who provide early peer coaching support would encourage teachers and teacher leaders to see the value of collaboration with peers and the accompanying frequent reflection on practice.

Early formal and informal mentoring experiences can be critical to creating an attitude focused on lifelong learning. Novice teachers generally seek to feel comfortable with their fellow colleagues and spend time early in their career trying to "get a feel" for the people, the campus climate, and the needs of their students. They also try to find a balance between their own needs for professional autonomy and accommodation to campus or district directives (Ferguson, 2006). Several of the participants seemed to find that balance and noted that others on their campuses besides their official mentors actively worked to help them evaluate teaching and learning in their classroom and reflect within their community of practice. Mentors, assigned or otherwise, included administrators, campus content specialists, nurses, librarians, and teachers in other



subjects. Ganser (2001) noted the importance of administrators and teacher leaders helping all the campus' faculty and staff understand that a formal mentor program does not replace their professional obligation to welcome newcomers into the community of practice. Some secondary, informal mentors with similar teaching assignments, or not, might also provide valuable guidance. Such support from all members of their communities of practice, experts as well as newcomers, enabled the construction of content, pedagogical, and contextual knowledge and the leadership dispositions that research finds nurture quality teaching and learning.

### **Observations and Modeling of Practice**

Observational situations that require teachers and teacher leaders to analyze others' instructional practice, to provide reflective feedback and discuss possibly relevant or different curricular activities, and to plan follow up activities based on formative data provide powerful opportunities for teacher and teacher leader growth. The observation and analysis of their own practice by others can also lead to leadership growth. The types of observations and the reflective coaching and consulting that occurred after each experience varied for the participants.

All were observed by their mentors, and participated in conversations about these one-way observations. Donna said she liked that her mentor was straightforward, telling her what she needed to do. Tomas saw his mentor as someone who would listen when he had any "complaints or any hardship." Neither indicated whether they observed their mentor, if reflective conversations occurred afterwards, or if they observed other teachers in similar positions on their campus. The other participants had multiple observations, that included their observing peers and in turn being observed by other professionals.

Reflective dialogue with all participants followed these two-way observations of teachers, of mentors and mentees, and of teacher leaders.

Implementation of new instructional practices presents challenges to all teachers, and particularly to those who are novices. Campus and district administrators can facilitate positive changes in instructional practice that supports increased student achievement by encouraging multiple observations and by ensuring that the role of the coach, mentor, or consultant in school-based professional development is clear to all parties in the situation. This gives the mentor confidence to model research-informed practices focused on student learning, to have an understanding of the differences between consultation and supervision, and to provide support for reflective feedback. It encourages the mentee to recognize the benefits of school-based professional development and its place in supporting lifelong learning. Kretlow and Bartholomew (2010) noted the value of a skilled peer providing support to a new teacher and that campus-based coaching should aim to provide a safe classroom environment for new teachers to experiment, fail, revise, and try again. Without feedback and accompanying reflection as a teacher tries to implement a newly learned practice, teachers may discontinue its use, or use it improperly.

Scheeler, Bruno, Grubb, and Seavey (2009) found that a teacher is more likely to use the strategy again if the new instructional behavior is directly reinforced in the setting where instruction typically occurs. Teacher leaders should see this modeling of instruction as an effective professional development strategy when working with peer teachers. Frequent opportunities to discuss incorrect uses of strategies with descriptive, non-evaluative feedback lead to successful implementation of new techniques (Kohler,

Ezell, & Paluselli, 1999). These discussions should be accompanied by an analysis of the strengths seen during observation to support teacher confidence in implementation. Fran saw that occur after her work with a struggling teacher, who she “inspired to seek the learning and professional development . . . needed.”

### **Teacher and Teacher Leader Characteristics**

Those characteristics that all of the participants valued for their future work as school-based teacher leaders were approachable, collaborative, and reflective. Aspects of these three attributes were cited by all, but several also commented about their understanding and valuation of equitable, credible, competent, assessment-focused, and research-focused. None of the participants ranked one characteristic, curriculum-focused, at the top of their list, although all assigned some points to that disposition during the interview process.

The perceptions of these emerging teacher leaders about the importance of various characteristics and dispositions that may impact their future work as a school-based middle school mathematics teacher leader varied although there were some similarities. The researcher defined several leadership characteristics identified in teacher leadership research, in the state’s standards for master mathematics teacher, and in the PRIME leadership framework of national mathematics teacher leaders. Because the participants’ own understanding of the identified characteristics and their early career experiences differed, there is a lack of common language surrounding teacher leadership characteristics. Therefore, each participant highlighted and ranked dispositions differently. This created some variances in perceptions and required careful data

analyses to ascertain participants' perceptions from their interview comments as well as their ranking of the characteristics.

Highlighting the importance of being constantly vigilant to build trusting relationships, the need for teacher leaders to develop relational capacity and to be approachable was mentioned often by all of the participants. This applied to building relationships with students as well as campus staff. They saw its significance to their being able to approach mentors, peer teachers, and administrators for advice and feedback, and also as an important characteristic for them to have when they step into teacher leadership positions on their campuses. Relationships that build trust also lead to the disposition collaborative, a characteristics that several saw as important. Those that ranked this lower seemed to have less support as either new teachers or emerging teacher leaders. An understanding of this characteristic may be affected by their mentoring and observational experiences. The reflective characteristic was not ranked as highly as other characteristics but the participant comments indicated they valued it as teachers and for their future work as teacher leaders with other teachers. Several teacher and teacher leaders recognized the importance of reflection, and several tied reflection and collaboration together.

### **Alignment of Perceptions to Standards**

The alignment of these teacher leaders' perceptions of characteristics important to their future work lined up with several of the characteristics prominent in the state's Master Mathematics Teacher Standard focused on mentoring and leadership: collaborative, reflective, equitable, and approachable. This standard prompts teacher leaders to assist peer teachers in reflecting on their teaching behaviors in collegial,

collaborative communication with all stakeholders, to build trust and collaboration with other school community members, and to build programs that ensure high expectations and equity in mathematics instruction for all students. The standard suggests the important role teacher leaders play in building trust and a collaborative spirit within a school's mathematics program. Equitable also surfaced often in comments even though the participants did not put it high on their lists of desirable dispositions. The participants recognized the importance of these four dispositions as detailed in the state standards, and their perceptions were aligned to the standards in these areas.

They also acknowledged that the development of leadership capacity and its attributes is supported by other characteristics. All nine of the researcher's identified characteristics or dispositions were seen as aiding them to effectively and efficiently perform as a school-based mathematics teacher leader. A focus on assessment by teacher leaders was seen as important to being able to inform instructional direction and to understand the needs of peer teachers. Being competent and credible were perceived as allied dispositions focused on mathematics content and on pedagogy. Some of these nascent teacher leaders did not recognize these characteristics in themselves or as important to their current work, but saw them as possibly developing at a later stage in their career. Although one of these emerging leaders (Tomas) saw curriculum-focused as addressing primarily the content in the textbook and the scope and sequence provided by the school district, he added that one should always be looking for better ways to deliver a lesson. Their comments about their early career experiences and their professional strengths revealed curriculum-focused activities in planning rich and engaging lesson plans for a wide variety of students. Several participants stressed the importance of

holding high expectations for all students, for themselves, and for their peers. This attribute supports the characteristic equitable. One participant described being research-focused as important because one should not just think about what may work during instruction, but one should make sure that research supports its use. Another's reflective comments suggested his struggle in considering and evaluating the application of research findings to instructional practices.

The vision of NCSM in creating the PRIME Leadership Framework was to lead to a better future for every child by encouraging mathematics educational leaders to take professional responsibility for their practice, as well as the practice of those they lead:

Leadership matters. . . . High-quality programs are grounded in school-level conditions that enhance adult professional development and learning, support research-informed practice, and are guided by leadership that supports the ongoing improvement of curriculum, instruction, and assessment (NCSM, p. 1).

The principles and their 12 research-informed, action indicators focus on equity leadership, teaching and learning leadership, curriculum leadership, and assessment leadership. The indicators describe the conditions that must exist and actions that must be taken to sustain implementation of each indicator.

The organization recognized the complexity of the development of leadership characteristics and noted their accompanying action indicators are on a leadership continuum that changes over time:

The ambitious vision of leadership in the PRIME Framework may take a lifetime of self-learning combined with an ongoing passion and push for systems change in a continuous effort to teach others how to lead (p. 7).

The participants recognized that their leadership skills may be at an early stage of development and they saw some characteristics as possibly being important later during their work with peer teachers and teacher leaders.

The national group's Cycle of Action and Learning consists of three stages: Leadership of Self, Leadership of Others, and Leadership in the Extended Community. The first stage prompts teacher leaders to exhibit leadership in self-knowledge, awareness, development, and modeling of the 12 leadership indicators. Such leaders are respected for their teaching and learning skills (seen as competent). The second "collaborate and implement" stage addresses their leadership within the mathematics program in the development of other teachers and administrators in their understanding of the principles and indicators. The leader is respected for interpersonal skills and commitment to ensure changes occur. Stage 3 addresses leadership taken in the extended community to create and maintain systemic implementation of the indicators. The leader is respected for his or her "influence and engagement with an expanded community of educational stakeholders" (NCSM, p. 6), that can include local, state, and national policymakers.

Leadership attributes highlighted in the framework are collaboration, reflection, and equity. The participants had some understanding of these three characteristics and their relationship to the principles and indicators laid out in the PRIME Leadership Framework. The organization noted that mathematics teacher leaders must engage their peers in collaborative activities that promote a culture of trust and consensus. Teacher leaders cannot do it alone and collaboration is key to the building of relationships that initiate and sustain actions focused on improved student achievement. Evidence of

involvement in a collaborative professional learning community was not apparent with two of the participants (Donna and Tomas), and it was impossible to ascertain their understanding of this critical characteristic from their comments. The pair did indicate that collaboration held some value for their future work, but did not display its use in their discussions. The others exhibited an understanding of this characteristic and the role it plays in the PRIME Framework's principles and indicators.

The Equity Leadership Principle calls for teacher leaders to support changes that ensure every teacher works “interdependently in a collaborative learning community to erase inequities in student learning” (p. 9). High expectations for each student, interventions and strong support for the learners, preparation and delivery of engaging lessons, and fostering continuous achievement growth for each student are some of the action indicators for this leadership principle. A strong data focus drives any initiative focused in this area. This group, in their Teaching and Learning Leadership Principle, suggests mathematics teacher leaders must engage every teacher in reflection regarding mathematics content, pedagogy, and assessment, and in appropriate professional learning:

The leader makes the commitment to share knowledge and address critical issues – such as time, equity, professional culture, leadership sustainability, and public support for the professional growth and learning of every mathematics teacher – and is committed to success regarding each of these issues (p. 31).

The Curriculum Principle and its indicators highlight use of curriculum and instructional resources that reflect state and national curriculum recommendations, implementation of relevant and meaningful mathematics, and the implementation of the intended curriculum in ways and with interventions that ensure it is attained by all students. The Assessment



Principle includes aspects that focus on learning opportunities, instructional alignment, common assessment, collaborative discussion about summative assessment data, and teacher dialogue regarding formative assessment and ongoing student assessment. These topics were not directly addressed during the interview process and the teacher leaders' understanding of this principle could not be determined.

Because the participants' leadership development is early in their career, their understanding of the PRIME Leadership Framework was limited to the major characteristics: collaborative, reflective, equitable, and approachable. The researcher would also categorize them as still in a learning phase of Stage 1 Leaders with all the leadership principles, just now understanding and developing those action and behavior indicators thought important by the national group. Some of the participants are moving into Stage 2 with three of the indicators, but it was not evident in the assessment category. This study confirmed the complexity of mathematics teacher leadership development and that it is a life-long career endeavor. Additional teaching and learning experiences will provide growth in leadership knowledge for these emerging teacher leaders.

### **Recommendations for Practice**

Frequent and varied classroom and campus experiences provide opportunities for potential, emerging, and current campus teacher leaders to develop the skills both state and national policymakers list as important for their work with peer teachers and teacher leaders. These experiences include observations of other teachers modeling instruction and receiving reflective comments from those who observe them during their practice and mentoring by a variety of people. A shared mentoring situation helps both mentors and

mentees in on-going professional development. Campuses and districts should appreciate the value of using collaborative and reflective team meetings to develop leadership capacity. The benefits of encouraging frequent informal and formal contacts between new or early-career teachers and more experienced teachers and others within the campus community of practice should not be overlooked. Included in the community of practice could be longtime campus volunteers, the community, administrators, non-professional employees on the campus, all teachers including those new to the profession, and others.

Other important supports for teachers that are increasingly recognized are those involving initial teacher mentoring, campus climate and activities, on-going professional development, and particularly time to both reflect individually and collaboratively with various grade-level, campus, and district teams. Without similar situations and supports and scheduled time to individually and collaboratively reflect about teaching and learning, emerging teacher leaders will not develop the skills needed to effectively and efficiently work with peer teachers in school-based instructional coaching situations. Besides frequent, regularly scheduled collaborative sessions with other teacher leaders, campus and/or district administrators should assign new teacher leaders two kinds of mentors, a teacher leader as well as an administrator mentor. These mentors would help them navigate the personal, campus culture, and professional issues that arise and further develop leadership characteristics to work with their peers. Shadowing another teacher leader several days each semester might also give the new leader insight into their role and responsibilities.

University programs that provide teacher leadership training for emerging teacher leaders will want to ensure all have opportunities as described above. They may also

want to require practicum activities that encourage collaboration with fellow potential teacher leaders and others about implementing meaningful and relevant mathematics curriculum and practices. Reflection, as always, should be an important part of such professional growth.

### **Suggestions for Future Research**

Further research about informal and formal mentoring relationships and about how the types of teacher instructional observations (one-way or multiple-ways) may be important to the professional development of nascent teacher leaders should be pursued. An understanding of communities of practice might add to teacher and teacher leader understanding of collaborative and reflective discussions in such communities and of its impact on the perceptions of leadership characteristics and dispositions by mathematics teacher leaders. Questions about who is influencing whom on campuses and within school districts are not yet fully answered nor understood. This research revealed that in some cases informal mentoring and coaching support for teachers and teacher leaders may be as important as formal mentoring assignments and encouragement. Thus, small campuses and districts will want to encourage such situations. Various opportunities for both informal and formal mentoring should be encouraged for all teachers on a campus, particularly those who are in their first years of teaching. Mentoring by multiple teachers provides the foundation for how new teachers view their practice and guides their view of the possibilities of future professional development.

Current concerns about budget constraints in many districts across the nation are causing cutbacks in campus- and district-level instructional leadership positions. The long-term consequences and effects of eliminating the support mentoring and coaching

specialists provide has not yet played out, nor has it been researched. A comparison of similar campuses within a district or regional area that provides school-based mathematics teacher leadership support and those that do not may reveal additional instructional concerns that the district-level administrators may be forced to investigate.

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APPENDIX A  
MASTER MATHEMATICS TEACHER STANDARDS  
STANDARD IX

## APPENDIX A. Master Mathematics Teacher Standards, Standard IX

### *Master Mathematics Teacher Standards — January 4, 2002*

**Standard IX. Mentoring and Leadership:** The Master Mathematics Teacher facilitates appropriate standards-based mathematics instruction by communicating and collaborating with educational stake-holders; mentoring, coaching, exhibiting leadership, and consulting with colleagues; providing professional development opportunities for faculty; and making instructional decisions based on data and supported by evidence from research.

#### **Teacher Knowledge: What Master Mathematics Teachers Know**

##### ***EC–12 Communication and Collaboration with Educational Stakeholders***

The EC–12 Master Mathematics teacher knows and understands:

- 9.1k the dual role of the Master Mathematics Teacher as a teacher and mentor in the school community;
- 9.2k leadership, communication, and facilitation skills and strategies;
- 9.3k principles, guidelines, and professional ethical standards regarding collegial and professional collaborations, including confidentiality in the mentoring relationship;
- 9.4k learning processes and procedures that facilitate peer learning and self learning;
- 9.5k how to facilitate positive change in instructional practices through participation in ongoing professional development opportunities (e.g., TEXTAMS, NCTM, CAMT, book studies, action research); and
- 9.6k how local, state, and national curriculum and assessment standards are related.

#### **Application: What Master Mathematics Teachers Can Do**

##### ***EC–12 Communication and Collaboration with Educational Stakeholders***

The EC–12 Master Mathematics Teacher is able to:

- 9.1s assist other teachers to reflect on their own teaching behaviors and attitudes to ensure high expectations and equity in mathematics instruction for all students;
- 9.2s collaborate with administrators, colleagues, families/guardians, and other members of the school community to establish and implement the roles of the Master Mathematics Teacher and ensure effective ongoing communication;
- 9.3s build trust and a spirit of collaboration with other members of the school community to effect positive change in the school mathematics program and mathematics instruction;
- 9.4s use leadership skills to ensure the effectiveness and ongoing improvement of the school mathematics program, encourage support for the program, and engage others in improving the program;
- 9.5s collaborate with members of the school community to evaluate, negotiate, and establish priorities regarding the mathematics program, and to facilitate mentoring, professional development, and family/guardian training;
- 9.6s confer with students, colleagues, administrators, families/guardians, and the community to discuss mathematics related issues; and
- 9.7s apply professional principles, guidelines, and ethical standards in collegial and professional collaborations.

## APPENDIX A. (Continued) Master Mathematics Teacher Standards, Standard IX

***Standard IX. Mentoring and Leadership: The Master Mathematics Teacher facilitates appropriate standards-based mathematics instruction by communicating and collaborating with educational stake-holders; mentoring, coaching, exhibiting leadership, and consulting with colleagues; providing professional development opportunities for faculty; and making instructional decisions based on data and supported by evidence from research.***

### **Teacher Knowledge: What Master Mathematics Teachers Know**

#### ***EC–12 Mentoring, Coaching, and Consultation***

The EC–12 Master Mathematics Teacher knows and understands:

- 9.7k skills and strategies for mentoring, coaching, and consultation in the development, implementation, and evaluation of an effective standards-based mathematics program;
- 9.8k differences between consultation and supervision; and
- 9.9k strategies for facilitating positive change in instructional practices through mentoring, coaching, and consultation.

### **Application: What Master Mathematics Teachers Can Do**

#### ***EC–12 Mentoring, Coaching, and Consultation***

The EC–12 Master Mathematics Teacher is able to:

- 9.8s apply effective mentoring, coaching, and consultation skills and strategies (e.g., observing, consensus building, providing feedback, decision making) to improve mathematics instruction for all students;
- 9.9s use mentoring, coaching, and consultation to facilitate team building for identifying needs related to mathematics instruction, developing strategies for addressing those needs, and promoting mathematical development;
- 9.10s use consultation to work effectively with colleagues with varying levels of skill and experience and/or different philosophical approaches to instruction to develop, implement, and monitor mathematics programs;
- 9.11s select and use strategies to maximize effectiveness as a Master Mathematics Teacher, such as applying principles of time management and engaging in continuous self-assessment; and
- 9.12s use consultation to improve the teacher’s ability to engage all students in the learning process.

***Standard IX. Mentoring and Leadership: The Master Mathematics Teacher facilitates appropriate standards-based mathematics instruction by communicating and collaborating with educational stake-holders; mentoring, coaching, exhibiting leadership, and consulting with colleagues; providing professional development opportunities for faculty; and making instructional decisions based on data and supported by evidence from research.***

### **Teacher Knowledge: What Master Mathematics Teachers Know**

#### ***EC–12 Professional Development for Faculty***

The EC–12 Master Mathematics Teacher knows and understands:

- 9.10k learning processes and procedures for facilitating adult learning;
- 9.11k strategies for facilitating positive change in instructional practices through professional development; and
- 9.12k models and features of effective professional development programs that promote sustained application in classroom practice (e.g., demonstration, modeling, guided practice, feedback, coaching, follow-up).

## APPENDIX A. (Continued) Master Mathematics Teacher Standards, Standard IX

### **Teacher Knowledge: What Master Mathematics Teachers Can Do**

#### ***EC–12 Professional Development for Faculty***

The EC–12 Master Mathematics Teacher is able to:

- 9.13s collaborate with teachers, administrators, and others to identify professional development needs, generate support for professional development programs, and ensure provision of effective professional development opportunities;
- 9.14s design ongoing professional development opportunities that address identified student mathematics needs, are appropriate for the intended audience, and are based on data and convergent research evidence;
- 9.15s use a variety of models and methods to create professional development opportunities that improve teachers' ability to implement effective mathematics instruction for all students; and
- 9.16s apply principles and procedures for delivering effective professional development and follow-up to promote and sustain positive change in the mathematics program.

***Standard IX. Mentoring and Leadership: The Master Mathematics Teacher facilitates appropriate standards-based mathematics instruction by communicating and collaborating with educational stake-holders; mentoring, coaching, exhibiting leadership, and consulting with colleagues; providing professional development opportunities for faculty; and making instructional decisions based on data and supported by evidence from research.***

### **Teacher Knowledge: What Master Mathematics Teachers Know**

#### ***EC–12 Decision Making Based on Evidence from Research***

The EC–12 Master Mathematics Teacher knows and understands:

- 9.13k sources for locating information about converging research on mathematics learning; and
- 9.14k methods and criteria for reviewing research on mathematics learning and selecting research for educational applications.

### **Teacher Knowledge: What Master Mathematics Teachers Know**

#### ***EC–12 Decision Making Based on Evidence from Research***

The EC–12 Master Mathematics Teacher is able to:

- 9.17s critically examine converging research on mathematics learning and analyze the usefulness of research results for addressing instructional needs; and
- 9.18s apply appropriate procedures for translating research on mathematics learning into practice.

APPENDIX B

THE PRIME LEADERSHIP FRAMEWORK OF

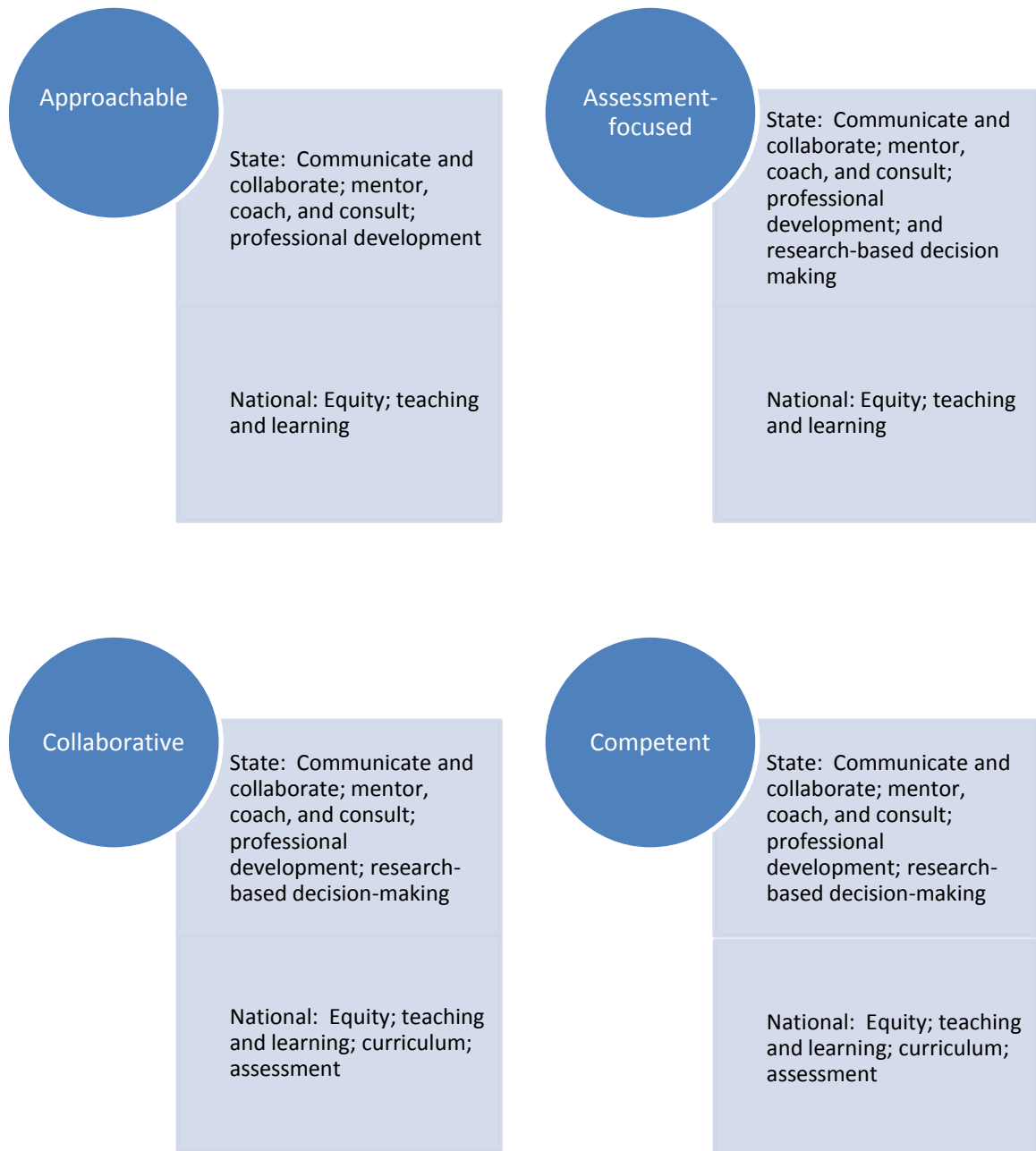
NATIONAL COUNCIL OF SUPERVISORS OF MATHEMATICS

## Appendix B. The PRIME Leadership Framework

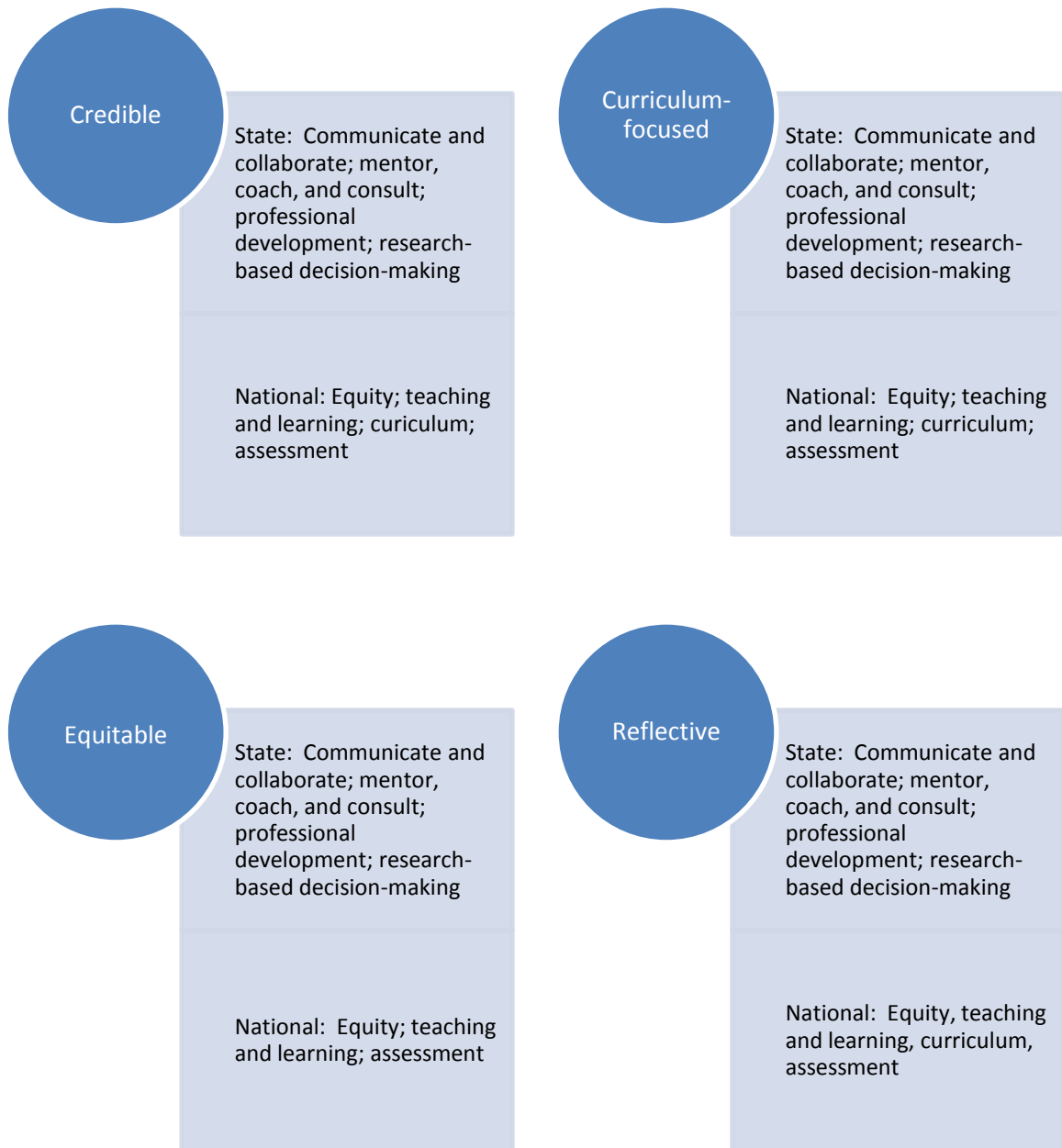
Principle	Indicator 1	Indicator 2	Indicator 3
Equity Leadership	Every teacher addresses gaps in mathematics achievement expectations for all student populations.	Every teacher provides each student access to relevant and meaningful mathematics experiences.	Every teacher works interdependently in a collaborative learning community to erase inequities in student learning.
Teaching and Learning Leadership	Every teacher pursues the successful learning of mathematics for every student.	Every teacher implements research-informed best practices and uses effective instructional planning and teaching strategies.	Every teacher participates in continuous and meaningful mathematics professional development and learning in order to improve his or her practice.
Curriculum Leadership	Every teacher implements the local curriculum and uses instructional resources that are coherent and reflect state standards and national curriculum recommendations.	Every teacher implements a curriculum that is focused on relevant and meaningful mathematics.	Every teacher implements the intended curriculum with needed intervention and makes certain it is attained by every student.
Assessment Leadership	Every teacher uses student assessments that are congruent and aligned by grade level or course content.	Every teacher uses formative assessment processes to inform teacher practice and student learning.	Every teacher uses summative assessment data to evaluate mathematics grade-level, course, and program effectiveness.

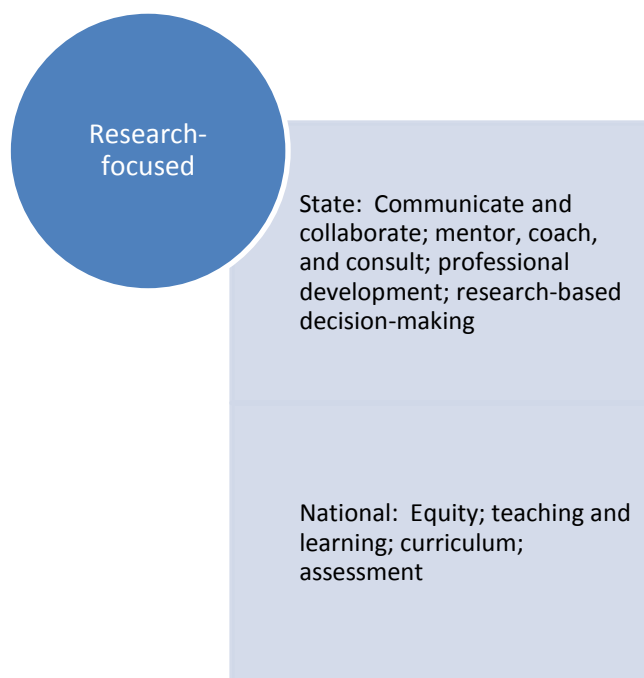
APPENDIX C  
TEACHER LEADERSHIP  
CHARACTERISTICS AND CORRELATION

## APPENDIX C. Teacher Leadership Characteristics and Correlation

**Framework of Teacher Leadership Characteristics  
and Correlation to State and National Standards**







Compiled and created from the research literature surrounding mathematics teacher leader characteristics and dispositions and from the Texas State Mathematics Master Teacher Standards (2002) and the principles and indicators of the PRIME Leadership Framework of the National Council of Supervisors of Mathematics (2008).

## APPENDIX D

### INTERVIEW PROTOCOL

### Interview Protocol

1. Describe your role as a mathematics teacher in your current position.
2. In your beginning years as a mathematics teacher, in what ways were you mentored/coached? Please describe.
  - a. In what ways was this a positive experience?
  - b. In what ways was this a negative experience?
  - c. What attributes about the mentor or about your campus contributed to making this a positive/negative experience?
3. Identify and describe 1-3 strengths of your teaching.
4. Identify and describe an area of your teaching you would like to improve upon.
5. In what ways have teacher leaders on your campus facilitated your professional growth? Please describe.
  - a. In what ways was this a positive experience?
  - b. In what ways was this a negative experience?
  - c. What attributes about the teacher leader or about your campus contributed to making this a positive/negative experience?
6. Have you mentored a new or struggling teacher on your campus? If yes:
  - a. Please describe this experience.
  - b. In what ways was this a positive experience?
  - c. In what ways was this a negative experience?
  - d. What attributes about you or about your campus contributed to making this a positive/negative experience?
7. Have you mentored a student-teacher on your campus? If yes:
  - a. Please describe this experience.
  - b. In what ways was this a positive experience?
  - c. In what ways was this a negative experience?
  - d. What attributes about you or about your campus contributed to making this a positive/negative experience?
8. Here is a list of 9 characteristics (with definitions) of teacher leaders that I have read about in the literature. You have a total of 100 points to allocate to these characteristics as a way of ranking to what extent you see the characteristic as important for being an effective middle school mathematics teacher leader. (They are listed alphabetically and not in any ranking order).
  - a. Please allocate your points and explain your point distribution.
  - b. Are there any characteristics missing from this list?
9. Do you have any questions for me?

## Leadership Characteristics

Approachable: Teacher leaders ensure their manner is approachable and friendly and that they remain accessible to peer teachers, administrators, parents, and the community.

Points \_\_\_\_\_

Assessment-focused: Teacher leaders make sure timely, accurate monitoring of student learning takes place, and adjust teacher instruction to improve student learning.

Points \_\_\_\_\_

Collaborative: Teacher leaders are reflective practitioners who build trust and a spirit of collaboration with other members of the school community to effect positive changes.

Points \_\_\_\_\_

Competent: Teacher leaders possess those abilities, commitments, knowledge, and skills needed to act effectively in various situations.

Points \_\_\_\_\_

Credible: Teacher leaders make certain their behaviors are consistent with expressed views so that they are perceived as believable and trustworthy.

Points \_\_\_\_\_

Curriculum-focused: Teacher leaders encourage relevant and meaningful mathematics in every lesson.

Points \_\_\_\_\_

Equitable: Teacher leaders hold and encourage high expectations. They provide access to meaningful learning for every student.

Points \_\_\_\_\_

Reflective: Teacher leaders encourage activities and behaviors leading to thoughtful consideration of practice, including the questioning of assumptions and outcomes.

Points \_\_\_\_\_

Research-focused: Teacher leaders implement research-informed best practices using effective instruction planning and teaching strategies every day.

Points \_\_\_\_\_

Missing characteristics?

\_\_\_\_\_ Points \_\_\_\_\_

## APPENDIX E

### PARTICIPANT ANALYSES

## APPENDIX E. Participant Analyses

Donna	Fran	James	Lucy	Tomas
<b>Mentoring</b>				
<u>Early career</u>  Not aware of novice teacher support; does not identify a mentor in her first year  Described mentor as she moved to another district as helpful, but with issues regarding equity when dealing with students who were not advanced/higher level learners	<u>Early career</u>  Had supportive mentoring/guidance as a new teacher from a teacher on same grade level, teaching same subjects (math/science)  Felt mentoring situation was good and set the right tone for her entire career  Lifelong learner, continuous relationship with mentor  Stresses the importance of self-reflection and sees support of administration as important during first years of teaching	<u>Early career</u>  Received informal mentoring , indirect coaching from variety of teachers  Had opportunity to observe practice of many classroom teachers as a special education co-teacher; saw that as a mentoring opportunity  Lifelong learner, reflective about practice and how special education training/experience prepared him for teaching, learning, and leading activities.	<u>Early career</u>  Had formal and informal support, including campus math specialist who spent week helping her set up classroom and expectations  Noted first campus had a more attentive, organized math specialist than current assignment; both were approachable and timely with advice  Perceives self as very organized and able to quickly learn  Received support from teachers with experience, ideas, and activities	<u>Early career</u>  Had official mentor, but stated he did not need much help as he had been a substitute in same grade using same textbook the previous year  Was appreciative for his mentors (informal and formal) or he would not still be teaching
<u>As a peer mentor</u>  _Not a good experience as a mentor herself  Disappointed in her own ability as a mentor -- lack of mentoring definition -- reluctant to suggest changes in practice to mentee -- made her more reflective of her own teaching	<u>As a peer mentor</u>  As a mentor to a new teacher --modeling, reflecting, feedback --recommended summer training (relates to her idea of being “lifelong learner”)	<u>As a peer mentor</u>  Stresses the importance of building relationships and approaching mentoring from a position of competency  Appreciates support of, and collaboration with, other math specialists during networking meetings; provides opportunities to reflect on coaching practice	<u>As a peer mentor</u>  Never served in a formal mentor position with a peer.  Informally, describes self as a mentor to her grade level team particularly at the beginning of the year in planning of activities and curriculum; able to keep peers focused on work being done  Describes campus and administrators as supporting collaboration with fellow teachers	<u>As a peer mentor</u>  Never served in a formal mentor position with a peer  Informally, describes to student teachers and one new teacher his own self-described “horrible” first year His message: Do not let students know your age or how long you have been teaching, and explained his “no warning” approach - -- students should already know consequences



Donna	Fran	James	Lucy	Tomas
Negative aspects while being mentored/coached				
<p>First year: very unsuccessful year with no support, teamed with one other teacher with another assigned grade level. Donna had a class of students who needed to pass the reading and math state assessments to go to next grade; her team member had to do the same with reading only. No other elementary grade levels faced such consequences. No opportunities to reflect on practice.</p> <p>Next position: Mentor did not understand struggling students and their learning needs; Donna did not agree with some of the suggested activities and strategies; did not feel mentor collaborated with her or other math teachers on the campus.</p>	<p>Only negative was how uncomfortable she felt when her mentor received a lower teaching evaluation than she did.</p>	<p>Voiced concerns that he had quite a bit to learn; did not feel ready to become a math teacher leader himself until he understood all the curriculum. Hesitated to step into those roles.</p> <p>Described his mentoring and coaching as all positive.</p>	<p>Timing became a negative because of the master schedule. Not being able to fit everything in; suggestions did not factor in transitions.</p> <p>Not having the physical things, i.e. manipulatives, to do the suggested activities.</p>	<p>Did not see any negative aspects; stressed that as the mentee it was his responsibility to implement the suggestions.</p> <p>Acknowledged he got off on the wrong foot and that was something to learn from. Switched districts his second year teaching.</p>

Donna	Fran	James	Lucy	Tomas
<b>Self-described Strengths of Current Practice</b>				
<p>Sense of humor; not a one-dimensional teacher</p> <p>Maintain open , on-going dialogue with students in classroom, encouraging students to try even if making mistakes</p> <p>Meaningful activities just beyond student reach to keep them challenged</p>	<p>Ability to reach all levels of students; has a patience students understand, especially with struggling learners</p> <p>Differentiates instruction but makes activities meaningful; students understand when they will use mathematics</p> <p>As a life-long learner, a strength is her self-reflection on practice</p>	<p>Sense of humor within a non-threatening environment</p> <p>Building relationships and interpersonal skills</p> <p>Love and passion for the students and their learning</p>	<p>Builds good relationships with students; makes them want to work</p> <p>Organized and very well planned</p> <p>Gives positive feedback to students; students feel safe to ask questions</p>	<p>Flexibility during instruction and ability to switch gears</p> <p>Empathy with his students</p> <p>Willingness to give time to the students; availability and accessibility</p>
Donna	Fran	James	Lucy	Tomas
<b>Self-identified Weaknesses of Current Practice or area needing improvement</b>				
<p>Wiser use of time, especially in lesson/activity preparation and planning</p> <p>Wants to ensure she works through computer programs she is having students do to avoid unexpected “bugs”</p>	<p>Use of technology within the classroom; reluctant to give up control yet students are often more capable of finding applications/uses within the classroom than she is</p>	<p>Needs/wants more experience with primary mathematics curriculum and students’ developmental stages (early-childhood through grade 2)</p>	<p>Ability to work with multi-level students within the same classroom during the same class periods</p> <p>Make work station activities more meaningful with high expectations for completion; trusting they can/will do the work on regular basis</p>	<p>Strict father-type teacher – yelling, tough, gun-blaring kind of feel; wishes to have a more personable approach with students</p> <p>Always looking to find better ways of lesson delivery so students will understand better and quicker</p>

<b>Donna</b>	<b>Fran</b>	<b>James</b>	<b>Lucy</b>	<b>Tomas</b>
<b>Self-described Strengths of Current Practice</b>				
<p>Sense of humor; not a one-dimensional teacher</p> <p>Maintain open , on-going dialogue with students in classroom, encouraging students to try even if making mistakes</p> <p>Meaningful activities just beyond student reach to keep them challenged</p>	<p>Ability to reach all levels of students; has a patience students understand, especially with struggling learners</p> <p>Differentiates instruction but makes activities meaningful; students understand when they will use mathematics</p> <p>As a life-long learner, a strength is her self-reflection on practice</p>	<p>Sense of humor within a non-threatening environment</p> <p>Building relationships and interpersonal skills</p> <p>Love and passion for the students and their learning</p>	<p>Builds good relationships with students; makes them want to work</p> <p>Organized and very well planned</p> <p>Gives positive feedback to students; students feel safe to ask questions</p>	<p>Flexibility during instruction and ability to switch gears</p> <p>Empathy with his students</p> <p>Willingness to give time to the students; availability and accessibility</p>
<b>Donna</b>	<b>Fran</b>	<b>James</b>	<b>Lucy</b>	<b>Tomas</b>
<b>Self-identified Weaknesses of Current Practice or area needing improvement</b>				
<p>Wiser use of time, especially in lesson/activity preparation and planning</p> <p>Wants to ensure she works through computer programs she is having students do to avoid unexpected “bugs”</p>	<p>Use of technology within the classroom; reluctant to give up control yet students are often more capable of finding applications/uses within the classroom than she is</p>	<p>Needs/wants more experience with primary mathematics curriculum and students’ developmental stages (early-childhood through grade 2)</p>	<p>Ability to work with multi-level students within the same classroom during the same class periods</p> <p>Make work station activities more meaningful with high expectations for completion; trusting they can/will do the work on regular basis</p>	<p>Strict father-type teacher – yelling, tough, gun-blaring kind of feel; wishes to have a more personable approach with students</p> <p>Always looking to find better ways of lesson delivery so students will understand better and quicker</p>

Donna	Fran	James	Lucy	Tomas
Positive Aspects of Teacher Leaders' Facilitation of Professional Growth/Development				
<p>Was encouraged by the math department chair to attend the annual state conference for mathematics teachers. It was expected that you would spend your summer "off" time learning about things you could bring back to your classroom and share with peer teachers. Expected that you would share learning with your team.</p>	<p>Praised early administrator's support at finding opportunities and encouraging her to pursue, including grant applications.</p> <p>A helping teacher, or specialist, also encouraged her to attend a special 4-week training at a prestigious private university. She describes the training as "life-changing" as far as teaching goes. Learned to really understand the content and how to best teach it. Fran, in turn, encouraged one of her struggling teachers to attend the same sessions, to great advantage for that teacher.</p>	<p>Has a colleague on the campus with mathematics content understanding and bounces ideas off her.</p> <p>Openness; Other mathematics team members aid in his understanding of how to use relationships to foster changes. Team members on some of the teams are very supportive of each other's growth, including James. Provide insight about fellow team members.</p> <p>Have provided understanding of importance of planning well together, having relationships, and functioning for what is best for students.</p>	<p>Teacher leaders keep teams positive and professional.</p> <p>Teacher leaders facilitate and encourage content knowledge development.</p> <p>Teacher leaders are visible.</p> <p>Teacher leaders facilitate weekly sessions from which teachers can walk away with ideas and reflection.</p> <p>Weekly sessions are consistent, with both teachers and administrators in attendance; such meetings prevent teacher isolation.</p> <p>Weekly sessions led to other development activities, such as classroom walkthroughs with peer teachers, which Lucy found helpful.</p>	<p>Confusing response: Availability of colleagues and administrators not in sync with his appreciation of autonomy in his classroom and appreciation of little or no micromanagement of what happens in his classroom.</p> <p>Campus was supportive of his attending classroom management professional development outside the district (Capturing Kids' Hearts).</p>

Donna	Fran	James	Lucy	Tomas
Negative Aspects of Teacher Leaders' Facilitation of Professional Growth/Development				
Although trainings were encouraged and in some cases expected, campus did not provide financial assistance.	Finances are crimping ability to take advantage of some opportunities.	Sometimes, as a math coach, James felt constraints on approaching teachers about issues. For example, may not have yet developed a good relationship. He did not always have campus-based personnel with whom to discuss this issue.	<p>Sometimes, the weekly sessions did not stay on topic. When this happened seemed like a waste of time.</p> <p>One project (visiting other classes) ended after only two sessions. The valued reflective questions and feedback ended as the campus prepared for spring state assessments.</p>	<p>No evidence of being accountable for his trainings, nor support from campus leaders for his learning there.</p> <p>He thought "Capturing Kids' Hearts" would help him move to a "more calm and more collected kind of approach to teaching and interaction with my kids." Continues to struggle with his classroom demeanor and acknowledges not able to implement the entrance greeting which is a hallmark of this training because of hall duty (a systemic issue), among other aspects of the training.</p>

Donna	Fran	James	Lucy	Tomas
Reflection and Collaboration				
<p>During work with a mentee, unable, too “shy” to provide feedback to the mentee. Saw things being done incorrectly but unable to speak up.</p> <p>However, she was able to be self-reflective about her own practice.</p> <p>Second mentor made decisions without collaborative discussion with the teacher teams. “(T)old you straightforward” what to do.</p> <p>Does not have anyone in current assignment with whom to discuss teaching and learning as she is only teacher of computer science (only member of her department).</p> <p><u>Collaborative</u> and <u>reflective</u> aligned with reflection more individual and collaborative with others. She ranked reflective in the second tier of dispositions and collaborative in the final tier.</p>	<p>Frequent reflective feedback from her mentor, fellow teachers, and a campus administrator.</p> <p>In her role as a campus instructional specialist was able to provide reflective feedback to other teachers.</p> <p>In her top tier of dispositions: <u>Collaborative</u>: “The other people make it a better idea by building on it.” <u>Reflective</u>: “. . . in a rut when you are not reflective about the teaching that we are doing.”</p>	<p>Routine district instructional specialist meetings provided time for collaboration and reflection.</p> <p>Saw <u>reflective</u> and <u>collaborative</u> leadership dispositions closely aligned.</p> <p>Thought self-reflection important when working with peer teachers, with whom one “spends most of the day.”</p> <p>In James top tier of leadership characteristics were two: <u>Approachable</u> and <u>Collaborative</u>: “falling back to those interpersonal relationships.” He ranked the rest of them evenly in a second group, including <u>reflective</u>. Recall he saw <u>reflective</u> and <u>collaborative</u> as closely aligned.</p>	<p>Was provided opportunity to reflect with other grade-level math/science teachers every Friday.</p> <p>Saw <u>collaboration</u> as important to prevent teacher isolation and to a healthy and open work environment. Listed it as one of four top dispositions; saw it as aligned with approachable, in her second tier with <u>reflective</u> and other characteristics.</p>	<p>Comments indicated he was reflective about his classroom management, but does not indicate collaborative conversations.</p> <p>His mentor helped him with lesson pacing and formative assessment.</p> <p>Opportunity must be present as he has had a co-teacher in his Title I classes (struggling students who failed state exam previous year) the past two years. However, he had made changes to the sequence of instruction, but appears not discussed with others. If it had been, his skipping the concept development and going directly to algorithm might have been challenged.</p> <p>Listed <u>reflective</u> as the most important characteristics for teacher leaders in their work with others, along with approachable. <u>Collaborative</u> was in his second tier of dispositions.</p>

Donna	Fran	James	Lucy	Tomas
<b>Approachable</b>				
<p>Thinks approachable is very important, for students, peers, administrators, and parents to see teacher leaders as approachable. Listed it, equitable, and assessment-focused as top on her characteristics list.</p>	<p>Described her mentor teacher as always available to answer questions and never condescending. Could watch her teach and then replicate her lessons. Also describes an administrator as approachable, indicating that she opened a lot of doors for her.</p> <p>Listed approachable at the top of her list as important characteristics, along with collaborative (aligning it somewhat with reflective.)</p>	<p>James addressed how he works with the staff on his campus varies., using different approaches with different teachers, yet he indicates there are plenty of peers on his campus that he can bounce ideas off of. Lists building relationships as one of his strengths. "...it is different approaches you have to take with different teachers in order to help them grow...everything starts with the relationship," "... there is not a person I cannot bounce ideas off."</p> <p>Listed approachable and collaborative at the top of his list of important characteristics.</p>	<p>Found all on her campuses willing to share and give ideas. Describes the campus specialists as being approachable in that they are visible. Even the kids "know who they are."</p> <p>Selected collaborative as one of her top characteristics, but thinks it goes with approachable, "your professional 'nice.'"</p>	<p>Indicates he is approachable to his students, and lists approachable as one of his top listed characteristics, along with credible and reflective. Thinks administrators do not have to see you are approachable because they are "higher on the food chain."</p>

Donna	Fran	James	Lucy	Tomas
<b>Assessment-focused</b>				
Believes assessment-focus is very important particularly as it relates to informing a teacher's instruction about improving student learning. Distinguishes between assessment of learning and assessment for learning in her discussion of the dispositions.	Links this characteristic with being reflective and equitable. Does not discuss how she uses assessment in any details, but comments on her strength of being able to differentiate fairly effectively to a whole range of kids. Formative assessment is probably part of these differentiation skills. She laments that she has trouble teaching teachers how to implement the ways she "reaches kids."	This characteristic, although thought important by James, is not at the top of his list (collaborative and approachable are), but in the second tier with all other characteristics. It is obvious he does, however, value the data that comes from various assessment, saying "You're tracking data. . . You're tracking information to check on progress." His comments indicate he values data for the information provided and that he understands the importance of using data to inform instruction.	Lucy listed assessment-focused at the top of her list, along with equitable, research-focused, and collaborative. She did not elaborate on assessment in this ranking, although she did with the others. Earlier in her interview lamented that the focus during the school year seems to turn to a focus on "how the students are going to do (on the state assessment)," and not on how they are going to do it. Focus shifts she feels too far to testing and away from learning and student thinking.	Indicated a big focus in his work on assessment, particularly because of the type of classes he is assigned – those who have failed the state summative assessment the previous year. Yet, he said he does not focus on "who counts" and "who doesn't," referring to sub-populations and the disaggregation of data that is part of campus accountability. Any growth is important in his mind he notes.. He does not discuss formative or informal assessment except at the very beginning of the interview when he noted his mentored helped him learn how to monitor progress and possibly change the pace of lessons.



Donna	Fran	James	Lucy	Tomas
Competent				
Sees competent as an important characteristic.	Links this characteristic with credible and feels if one is not competent, one cannot be credible. Talks about it as possibly being “fluff,” if not accompanied by some of the other characteristics.	Addresses fact one could be competent, but if not collaborative or approachable, the information will not be conveyed to peer teachers. He himself indicated how important he feels competent is, by waiting several years before becoming a campus-based math coach. He did not feel competent in how early childhood students learn mathematics and wanted to master that before becoming a math coach. He still feels he needs knowledge growth in that area, listing it as something he wants to work on.	Although she ranked this characteristic in the lowest tier, she said she did not think they were not important. She feels that competent and credible are developed at a later stage of teacher leadership development or are not as highly ranked as the others.	Ranks competent as high on his list, along with reflective. Feels teacher leaders must know their mathematics content, but it also refers to “how you teach it, too.”

Donna	Fran	James	Lucy	Tomas
<b>Credible</b>				
Indicates her mentor, who seemed to “pretend” she understood the issues with struggling learners, was not seen as credible by Donna. Does not find current department chairperson as credible as she has no power or authority. Aligns credible with approachable. Does not see one as approachable if not credible.	Ranked credible in a lower tier, noting it kind of goes with competent. Several characteristics are ranked here and Fran sees them as allied with some of one’s other dispositions. Has encountered teachers she thought credible, but it may be based more on personality than mathematics knowledge.	Stated credible is linked to all the remaining characteristics, with approachable and collaborative much higher on his list. He talked about how important credibility was to being able to do your job as a math coach or instructional leader. Otherwise, the teacher receiving some feedback would not take what you say and apply, or may not even listen to you.	Saw credibility in the peer teachers and team leader she worked with, with plenty of immediate, good advice. Thought competent and credibility might be characteristics to work on as a teacher leader at a later time. First, she said, teacher leaders should concentrate on equitable, research-focused, assessment-focused, and collaborative, first. Others can be developed later.	<p>Tomas appears to believe that by telling his first-year story, he is seen as credible by other new or struggling teachers. He thinks his tales make it more realistic and that teaching does “get better..”</p> <p>Initially chose credible as high on his list, but switched it out for competent.</p> <p>Does not think use of videos in professional development is credible because one’s own classroom may not look like the one portrayed in the video.</p> <p>Comes back to the importance of credibility again, but does not raise the points given. Spends a long time in the interview talking about how some teachers don’t “walk the talk,” so to speak and maybe do not have credibility.</p>

Donna	Fran	James	Lucy	Tomas
<b>Curriculum-focused</b>				
Found her second mentor (at the larger school) as more curriculum-focused, and in charge of the curriculum. Was straightforward and appreciated. Describes being able to create meaningful activities as one of her teaching strengths. Believes in constantly challenging students with activities just beyond their reach. In describing a weakness, indicated again her characteristic of curriculum-focused. She said she needs to improve lesson preparation -- time spent on it and time to work out any "bugs," before students try. How leadership roles are currently set up on her campus "is not working" because of having one department head, three divisions (lower, middle, upper grades). Although her comments suggest she is curriculum-focused, she ranked it pretty low.	Does not address curriculum-focus as important in her ranking of the nine identified characteristics. However, she indicates she values being reflective about curriculum and ensuring one is using best practices that are research-based during classroom activities.	Ranked curriculum-focused evenly with most of the dispositions listed in the interview question. Obviously valued an understanding of early childhood mathematics knowledge, noting it as an area to improve and waiting a couple years to get some background in that early development of number sense. He notes the importance of the early years' learning to future development and understanding.	Indicated curriculum-focus were characteristics of her mentor and teacher teams. She also worked with peer teachers at the beginning of the year to lay out the curriculum and apparently was seen as a leader because of that. Ranked curriculum-focused with approachable and reflective in her second tier of characteristics.	Acknowledges that teachers' seeking better ways to deliver a lesson is important, so that one makes changes to help students understand the concept quicker and better. Does not like the scope and sequence provided by the school district and indicated he, and others, made changes to it. He found it confusing in that the district curriculum did not follow the textbook sequence. Indicated he and his partner did follow the textbook timing the first year on the campus, with little modification. Did indicate he was focused more on computation skills than concept development in his discussion of teaching multiplication and division of fractions. Ranked curriculum-focused in his second tier (approachable and competent were highest).

Donna	Fran	James	Lucy	Tomas
<b>Equitable</b>				
<p>Equitable and approachable were Donna's highest ranking characteristics. Noted one should have high expectations for the faculty as well as the students. She noted that high expectations were key to success.</p> <p>Earlier she noted that her first mentor (in her second positions) held high expectations for both students and staff. However, she lamented that the mentor did not have a good understanding of what might work in instruction for the lower-achieving students. She found her mentor's suggestions unrealistic and ineffective.</p>	<p>Talked about how she has patience with kids that they understand. Is able to differentiate fairly effectively to a whole range of students. Prefers working with the academically struggling students. If one is formative assessment focused, one will be equitable.</p>	<p>Addresses this characteristic when talking about how it can be difficult to break "whole group" habits with long-time teachers. Whole group instruction often overlooks struggling students. Concerned that some teachers are unwilling to make changes in their practice to research-based ones. He notes that although his campus has been exemplary (highest state accountability ranking), there are instructional issues and instructional and teaching gaps.</p>	<p>While discussing relationship building, Lucy talked about how she "makes them want to work." Stressed positive feedback and being quite visible and present in the classroom, walking around. Addressed how her classroom is "safe." Has taught all ranges of students and understands that what might work with one group may not with another. Gave equitable her highest points (15) along with research-focused, assessment-focused, and collaborative. It is important she said to encourage high expectations, because some students may not even realize how good they can do.</p>	<p>Tomas may not have understood equity as it pertained to instruction. His comments about "really getting" to teach in an Algebra I class. He said he felt like a teacher in that class and really got to teach math.</p> <p>He stated that he has a style that includes "putdowns," raising his voice, but such interaction is "calculated." And never out of control.</p> <p>Places equitable in his second tier of qualifications and comments that it is the basic premise of No Child Left Behind, the federal accountability system. Also talks about he would not want to teach what his campus calls the "Tier 3" students, those special education students who take modified or accommodated students.</p> <p>Budgets and leadership may present him with that challenge this year or in the near future. Indicated such assignments have much to do with whether administrators like you.</p>

Donna	Fran	James	Lucy	Tomas
<b>Research-focused</b>				
Donna put research-focused at the bottom because of its constantly changing nature. Thinks it would be difficult for a teacher leader to keep up the newest research all the time.	Fran cautions that just filling time with worksheets or your favorite lesson will not work. Teachers have to do the work in looking at research because textbook companies are not going to do so for you. She ranked it in her mid-range group.	Does not rank research-focused on the top tier, yet generalizes the philosophy of special education to general education, everything small group, hands-on, tracking data, tracking information to check on progress, all research-supported activities.	Lucy highlighted research-focused, as among her top four dispositions valued, noting that it is important not to just “think about what may work” in instruction, but to make sure that research supports its use. She talks about active learning and movement in the classroom and how it rang true for her.	Gave it the smallest number of points, stating he is quite selective in how he uses research. Skeptical about applying it in his classroom, especially considering whether findings reflect what was really happening in the classroom, whether a research report or a video. He stated he does look at research and some pieces of it, but did not elaborate.

## APPENDIX F

### PARTICIPANT INVITATION

### **Participant Invitation**

Thank you for allowing me to request your participation in my doctoral research study.

All 17 participants in the University of Houston MMT program are being invited to participate in a research study involving characteristics, dispositions, and knowledge of emerging Middle School mathematics teacher leaders. The significance of the study is that it will provide information about the perceptions of the leadership construct of emerging mathematics teacher leaders to state and national agencies and researchers, to professional development providers, to universities working with pre-service and in-service mathematics teachers, and to individual campuses and school districts.

Participation is entirely voluntary. You may decide to withdraw at any time. During the approximately 60-75 minutes interview to be arranged at a mutually convenient time and location over the next three-four weeks, you may refuse to answer any questions. If a telephone interview meets your time commitment, it can be arranged, although the researcher prefers a face-to-face interview. Participation, or non-participation, will in no way affect your status or grades in the MMT program. An additional 30 minutes to review the transcript of your interview will also require your attention.

Every effort will be made to maintain the confidentiality of your participation in this project. Each name will be paired with a code number by me. This code number will appear on all written materials. The list pairing your name to the assigned code number will be kept separate from all research materials and will be available only to me. Confidentiality will be maintained within legal limits.

The results of this study may be published in professional and/or scientific journals. It may also be used for educational purposes or for professional presentations. However, no individual will be identified.

Please decide over the next week whether you wish to participate as study subjects.

If you have any questions about the process, the study, your rights as a participant, or time involved, you may contact me through the office of Dr. Jennifer Chauvot, Assistant Professor, at 713-743-9864, or my mobile phone at 713-598-3495.

*Maryann L. Siegmyer (McDaniel)*

## APPENDIX G

### CONSENT TO PARTICIPATE IN RESEARCH



## UNIVERSITY OF HOUSTON CONSENT TO PARTICIPATE IN RESEARCH

### PROJECT TITLE:

Knowledge and Characteristics of Emerging Mathematics Teacher Leaders: Becoming a School-based Middle School Teacher Leader

You are being invited to participate in a research project conducted by Maryann L. Siegmyer from the Department of Curriculum and Instruction, College of Education, at the University of Houston. The project is part of Ms. Siegmyer's dissertation in partial fulfillment of the requirements for the degree Doctor of Education and is under the supervision of Dr. Jennifer Chauvot, Assistant Professor.

### NON-PARTICIPATION STATEMENT

Your participation is voluntary and you may refuse to participate or withdraw at any time without penalty or loss of benefits to which you are otherwise entitled. You may also refuse to answer any questions. As a student, a decision to participate or not, or to withdraw your participation, will have no effect on your standing.

### PURPOSE OF THE STUDY

The one-month project will examine the characteristics, dispositions, and knowledge emerging middle school mathematics teacher leaders perceive as important to their work with peer teachers in a school-based learning situation. The research findings will also be examined in comparison to standards and frameworks of state and national policymakers.

### PROCEDURES

You will be one of 17 subjects asked to participate in this project. You will be asked to participate in a face-to-face interview with the principal investigator during which you will share your understanding and beliefs about knowledge of mathematics content, mathematics pedagogy, and leadership dispositions. The initial interview will last 60-75 minutes with follow-up interviews if needed for clarification. Your participation will be audio-recorded and transcribed for your later review. The total time commitment should be around two hours, including that later review. A sample interview question follows:

*In what ways have teacher leaders on your campus facilitated yours (or others) professional growth? Please describe. In what ways were these positive experiences? In what ways were these negative experiences? What attributes about the mentor or about your campus contributed to making these positive/negative experiences?*

**CONFIDENTIALITY**

Every effort will be made to maintain the confidentiality of your participation in this project. Each subject's name will be paired with a code number by the principal investigator. This code number will appear on all written materials. The list pairing the subject's name to the assigned code number will be kept separate from all research materials and will be available only to the principal investigator. Confidentiality will be maintained within legal limits.

**RISKS/DISCOMFORTS**

The risks associated with this study are minimal, and are not greater than risks ordinarily encountered in daily life. There are no foreseeable risks. However, in the event that you feel you need to talk to someone about issues raised during the interview, you can call University of Houston Counseling and Psychological Services (CAPS) at 713-743-5454. If after hours or on weekends, contact Mental Health Mental Retardation Authority (MHMRA) at 713-970-7000 or Crisis Intervention of Houston at 713-468-5463.

**BENEFITS**

You will receive no direct benefit from participating in this study; however your participation may help investigators better understand the characteristics and dispositions of emerging mathematics teacher leaders.

**ALTERNATIVES**

Participation in this project is voluntary and the only alternative to this project is non-participation.

**PUBLICATION STATEMENT**

The results of this study may be published in professional and/or scientific journals. The results may also be used for educational purposes or for professional presentations. However, no individual subject will be identified

## APPENDIX H

### DEBRIEFING STATEMENT

*Knowledge and Characteristics of Emerging Mathematics Teacher Leaders:  
Becoming a School-based Middle School Teacher Leader*

DEBRIEFING STATEMENT

Thank you again for helping me with this study. The interview you just participated in was to provide data for my dissertation in partial completion of a degree plan to receive an Ed.D in Curriculum and Instruction, Mathematics Education, from University of Houston.

As you were informed before the interview, your participation was totally voluntary, you could quit anytime or omit any question(s), any names used or recorded will be replaced with pseudonyms, and I was willing to answer any questions you may have had any time during the interview.

This research study has been reviewed and approved by the University of Houston Committee for the Protection of Human Subjects. For research-related problems or questions regarding subjects' rights, the Institutional Review Board may be contacted at 713-743-9204.

Also, in the event that you feel you need to talk to someone about issues raised during the interview, you can call University of Houston Counseling and Psychological Services (CAPS) at 713-743-5454. On evenings or weekends, contact Mental Health Mental Retardation Authority (MHMRA) at 713-970-7000, or Crisis Intervention of Houston at 713-468-5463.

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Participant's Signature & Date Indicating Receipt of Debriefing Statement

