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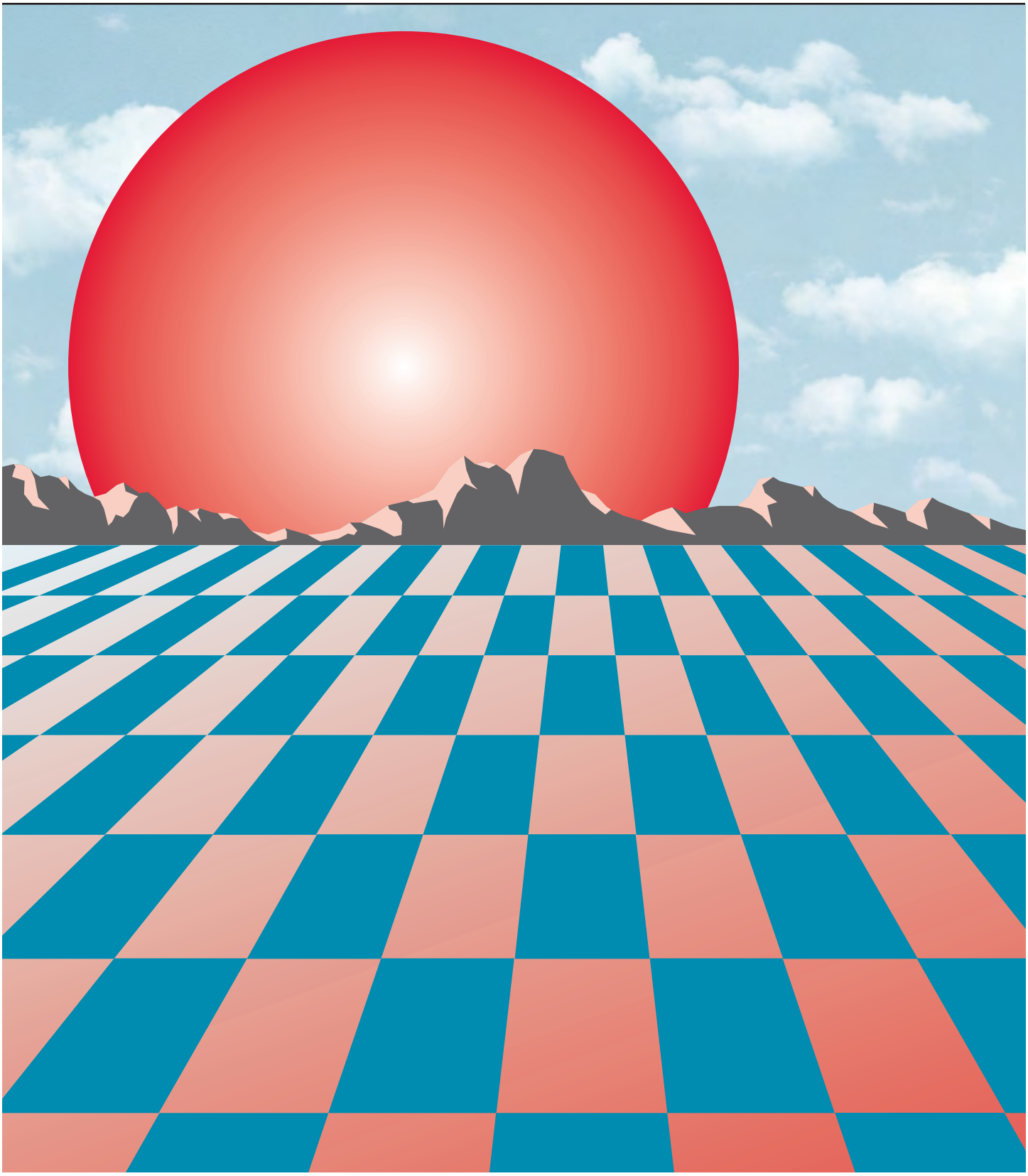

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A Mathematics Teacher Leader Profile:
Attributes and Actions to Improve Mathematics Teaching & Learning

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In response to *A Nation at Risk* (1983), two different groups looked at high quality teaching: the Carnegie Task Force on Teaching as a Profession and the National Council of Teachers of Mathematics (NCTM). Discussions of high quality teaching naturally leads to a growing emphasis on teacher leadership, high quality teachers who guide others (Dozier, 2004). Having effective mathematics teacher leaders is crucial to improve mathematics teaching and learning. In this article, I begin by presenting the national document created by these two groups and the profiles they offer for teacher leaders. Next, I review the literature on teacher leadership in general and mathematics teacher leadership, more specifically. Then, based on the national documents, research, and my experience working with teachers who want to become teacher leaders, I propose a mathematics teacher leader profile, including attributes and actions. Following the profile, I address measures that teacher leaders can take to help both themselves and colleagues create a mathematics reform classroom environment. I close with concluding remarks and what I envision as the future of mathematics teacher leaders.

National Teacher Leader Profiles

As stated earlier, both the Carnegie Task Force and NCTM responded to the 1983 report with documents emphasizing how schools and teachers could be better prepared for national school improvement. These offered recommendations and included national standards to ensure that all children were receiving a high quality education (NCTM, 2000). One of the main recommendations by the Carnegie Task Force was to create a national certification for teachers founded on high standards and addressing the prompt *What teachers should know and be able to do*. NCTM's *Professional Standards for Teaching Mathematics* (1991) addressed what high quality teaching looks like in mathematics education. These two documents offer some beginnings in looking at attributes of a mathematics teacher leader.

Carnegie Task Force: National Board for Professional Teaching Standards

The Carnegie Task Force report argued that "teachers should become leaders in curriculum, instruction, social redesign, and professional development and that the real power to improve achievement lay with teachers" (Lieberman & Miller, 2004). Upon the recommendation of the Carnegie Task Force, the National Board for Professional Teaching Standards (NBPTS) was created as a national certification process for classroom teachers. The Carnegie Task Force and ultimately the NBPTS knew high quality teaching existed and needed to be nationally recognized and documented. The NBPTS offers five propositions followed by more specific detail to answer the central focus of *What teachers should know and be able to do*.

These five propositions provide a possible profile for teacher leaders (See Appendix A for the complete list). Proposition 1 states *Teachers are committed to students and their learning*. Teachers recognize that all students are unique, understand how students learn, treat students equitably, and change their practice accordingly. Proposition 2 says *Teachers know the subjects they teach and how to teach those subjects to students.* Teachers know the complexities of their subject, how to present those complexities to students, and provide multiple paths to student understanding. Proposition 3 states *Teachers are responsible for managing and monitoring student learning*. Teachers invoke

multiple methods of teaching, promote collaborative learning, and consistently check student progress. Proposition 4 says *Teachers think systematically about their practice and learn from experience*. Teachers make difficult choices and call on colleagues and research to inform their practice. Proposition 5 states *Teachers are members of learning communities*. Teachers collaborate with other professionals, parents, and the community (NBPTS, 2005).

NCTM: Professional Standards for Teaching Mathematics

In 1991, NCTM's publication of the *Professional Standards for Teaching Mathematics* was an attempt, like the NBPTS, to set a national precedent for what "good" mathematics teaching looked like to help students, teachers, parents, administrators, teacher educators, and policy makers "see" high quality teaching. With the publication of these standards, the discussion around high quality mathematics teaching became a little easier; a document now existed from which the conversation could begin.

The document contains four different sets of standards, all addressing quality mathematics teaching (See Appendix B for the complete list). The first set, *Standards for Teaching Mathematics*, includes worthwhile mathematical tasks, both the teacher and student role in discourse, and the analysis of teaching and learning. The second set, *Standards for the Evaluation of the Teaching of Mathematics*, addresses teacher participation in evaluations, mathematical concepts, mathematical dispositions, and mathematical understanding assessment. The third set, *Standards for the Professional Development of Teachers of Mathematics*, includes experiencing good mathematical teaching, knowing mathematics and school mathematics, and developing as mathematics teachers. Finally, the fourth set, *Standards for the Support and Development of Mathematics Teachers and Teaching*, addresses the responsibilities of policy makers, schools, universities, and professional organizations in improving mathematics education (NCTM, 1991).

Teacher Leadership Literature

As the NBPTS and NCTM provide possible profiles for teacher leaders, others have also done research on the topic. In 1991, Pat Wasley was one of the first researchers to use data from teacher interviews and observations in her book *Teachers Who Lead: The Rhetoric of Reform and the Realities of Practice*. In interviewing and observing three teachers leaders, Wasley profiled each to allow others to "see" what teacher leadership looked like. In these three in-depth case studies, Wasley was shocked at the complexity of the teacher leader role (Wasley, 1991). The roles involved power, authority, decision-making relationships, different kinds of collaboration, and communicating beliefs about teaching and learning. Factors that allowed these teacher leaders to be successful with their colleagues also constrained them. In this section, I review more general literature on teacher leadership, like that of Wasley's book, and then I look at more specific mathematics teacher leadership literature.

Teacher Leadership

Related to Wasley's work, other researchers have surveyed, interviewed and observed teachers in order to better understand teacher leadership. Several common themes emerge throughout research findings: trust and relationships, political understanding, knowledge of change, and teaching and learning expertise.

Trust and the importance of building relationships with colleagues, administrators, and community members is a shared characteristic across the research. Teacher leaders employ a set of skills involved in building both trust and rapport in addition to creating a confidence in others (Miles et al., 1988). Management of interpersonal relationships and communication skills are characteristics of teacher leaders (O'Connor & Boles, 1992).

In addition to trust, teacher leaders also are aware of the political climate in which they work. They understand how power and authority contribute to decisions made in education (O'Connor & Boles, 1992). Teacher leaders recognize that schools operate as organizations dealing with power dynamics (Miles et al., 1988). Teacher leaders use their knowledge of the political climate in making decision and building relationships (Lieberman & Miller, 2004). Connected to trust, Fullan (2002) says teacher leaders embody a sense of "moral purpose" which he defines as a "principled behavior connected to something greater than ourselves that relates to human and social development" (Fullan, 2002).

As change is inevitable, teacher leaders understand its impact on schools and the teaching and learning that take place within them. Teacher leaders have a clear knowledge of how change happens (Fullan, 1994). They can also deal with change as well as adapt when it occurs (Miles et al., 1988; O'Connor & Boles, 1992). This adaptability prevails in teacher leader characteristics.

Another characteristic of teacher leaders is their expertise of teaching and learning. Teacher leaders not only understand the complexities of teaching and learning (Fullan, 1994), but also influence their peers in the two endeavors (Katzenmeyer & Moller, 2001). They understand that teaching and learning are lifelong processes. Teacher leaders engage in self-inquiry and share their discoveries with colleagues (Miles et al., 1988; Lieberman & Miller, 2004).

Throughout these various lists of teacher leader characteristics, there is considerable overlap. Many researchers seem to agree on the importance of building trust among colleagues and being a part of a learning community. Also, many mention the importance of understanding how organizations work and the political arena within which schools operate. Several researchers mention the understanding of the change process and the willingness to take risks as key components to teacher leadership.

Mathematics Teacher Leadership

As the literature on teacher leadership has grown over the years (York-Barr and Duke, 2004), some researchers are beginning to concentrate on more specific forms of teacher leadership. In this section, I look at literature that specifically addresses teacher leadership in the context of mathematics education.

Similar to the literature on teacher leadership, this body of literature also finds that teacher leaders build relationships and understand the change process (Miller et al., 2000). More specifically, this body of literature focuses on the teacher leader's expertise in mathematics and the mathematics classroom (Langbort, 2001). In her list of *Who are Teacher Leaders?*, Langbort lists eighteen attributes of a mathematics teacher leader including being a mentor to other mathematics teachers, a spokesperson for mathematics education, and an active member of the mathematics education community.

Being a mathematics teacher leader also involves understanding the complexities of the change process (Fullan, 1994). Research into professional development of mathematics and science teachers has revealed just how complex the change process can be. The Concerns Based Adoption Model (CBAM) outlines the stages teachers go through when implementing an innovation, such as new curricula, that they may or may not support (Hall & Hord, 1987; Loucks-Horsley, 1996). Even change supported by a teacher leader can be difficult; the CBAM model offers insight into the implementation process. The Concerns Based Adoption Model (CBAM) "applies to anyone experiencing change" and holds that "people considering and experiencing change evolve in the kinds of questions they ask and in their use of whatever the change is" such as "What is it? How will it affect me?…Is this change working for students? Is there something that will work even better?" (Loucks-Horsley, 1996). With assumptions such as the importance of understanding the change process from the participant's view, the complexities of mathematics teacher leadership are clear.

Another complexity found in the literature calls teacher leaders to develop relationships and build a "critical mass for change" (Miller et al., 2000). A crucial factor that both Miller et al. (2000) and Fullan (1994) address is the need to build relationships with individuals who hold different opinions or may disagree with one another. Sustainable change does not occur when the critical mass for change all look alike and think alike. Langbort (2001) talks more specifically to the classroom teaching practice of mathematics teacher leaders and also to their responsibility to represent mathematics education to the larger community.

A Mathematics Teacher Leader Profile

Thus far, the literature on teacher leadership has largely offered teacher leader attributes with few including specific examples of how those attributes are enacted. As the mathematics teacher leaders are crucial in improving teaching and learning, a need exists for more concrete examples of how teacher leaders would translate those attributes into action. Therefore, I created a profile of a mathematics teacher leader that includes not only attributes, but also actions.

The profile is organized in a table (Table 1) to make it as clear as possible. The first column simply lists numbers to aid in referring to the attributes in the discussion following the profile. The second column addresses the "Attributes" necessary in teacher leadership. The third column addresses the "Actions" that a teacher leader with that attribute would take to improve teaching and the profession. The fourth column provides references from the literature that support each attribute.

I do not consider this an exhaustive list of all the attributes of a mathematics teacher leader, as I am sure others may alter it. Rather, this list is my attempt to incorporate my own thoughts about teacher leadership with the previous

attributes found in the literature. The inclusion of thirteen attributes was not intentional on my part, I merely made a list of the attributes that best described a mathematics teacher leader and when I finished, thirteen attributes and actions were the result. Whereas some may see the action statements as narrowing, the intention is to offer practical examples of how each attribute may be enacted in practice. I see the actions as mere beginnings from which to build a longer list and hence a stronger connection between a general attribute and a concrete action.

TABLE 1: ***Attributes and Actions of Mathematics Teacher Leaders***

#	Attribute	Action	Literature Support									
			Miles et al. (1988)	NCTM (1991)	O'Connor & Boles (1992)	Fullan (1995)	Miller et al. (2000)	NCTM (2000)	Katzenmeyer & Moller (2001)	Langbort (2001)	Lieberman & Miller (2004)	NBPTS (2005)
1	Mathematical content expert	Teacher continually participates in mathematical content professional development through school, district, and local universities.		X			X					
2	Mathematical pedagogical content expert	Teacher continually participates in mathematical pedagogical content professional development including lesson study groups as well as collaborative observation teams to critically study practice in constructive ways.	X	X			X	X			X	X
3	Cultivates teacher leaders	Teacher builds teacher leaders. Just as teaching has the ultimate goal of making teachers unneeded, so too does leading have the ultimate goal of making leaders unneeded.	X	X		X	X			X	X	X
4	Able to look objectively at own practice and be open to change	Teacher participates in teacher research and lesson study, recognizing that change means "bumpiness" (Fullan, 2005). Fullan (2005) used the example of a rock and simple physics: A rock that is still does not want to move. It only takes a small bump to roll the rock. Once the rock is rolling, it does not want to stop. "Whatever something is doing, it wants to keep doing" — known as inertia.			X	X					X	X
5	Gains trust	Teacher genuinely listens and cares about others' opinions (particularly those in disagreement) of students, colleagues, administration, and the community.				X	X		X	X	X	
6	Member of a learning community (Wegner, 1998)	Much research (Wegner, 1998) has been done recently about professional learning communities. Both Barth (2001) and Fullan (2002) say teacher leadership cannot happen with individuals; it must happen in groups. Teachers intentionally join communities of practice where they discuss classroom teaching and new strategies. Members of the group must have varying viewpoints for the group to be effective as well as a change-oriented rather than a status quo oriented agenda.	X			X				X	X	X

(TABLE CONTINUED ON NEXT PAGE)

TABLE 1: *Attributes and Actions of Mathematics Teacher Leaders* (*CONTINUED FROM PREVIOUS PAGE*)

#	Attribute	Action	Literature Support									
			Miles et al. (1988)	NCTM (1991)	O'Connor & Boles (1992)	Fullan (1995)	Miller et al. (2000)	NCTM (2000)	Katzenmeyer & Moller (2001)	Langbort (2001)	Lieberman & Miller (2004)	NBPTS (2005)
7	Believes all students can learn and all teachers can teach	Teacher encourages students to enter the teaching field. In order for all students to know they can learn, they must see mentors that have preceded them who have learned and succeeded. Teacher cultivates teachers from within the classroom and community. Teachers must work with other teachers in the belief that teaching practices can improve.								X		X
8	Advocate for students and teachers	Teacher attends meetings inside and outside schools and speaks up when actions proposed or taken negatively impact students and teachers.		X		X						X
9	Mathematics teacher ambassador	Teacher talks about practice in terms that individuals outside the classroom, school, and community can understand. Teacher addresses concerns of the public by talking about what teachers and students do.		X		X	X		X	X		
10	Understands political nature of classroom teaching	Teacher recognizes that every classroom move is political. Teacher reads more about political nature of classrooms (and larger school and educational field) and carefully observes how such politics play out.		X		X	X			X	X	
11	Capacity to create and execute action plans	Teacher develops an action plan when a need for change is observed. Detailed steps are laid out and possible roadblocks identified. Proposed strategies for overcoming those roadblocks before the action plan begins are included. Then, the action plan is executed and modified as the paper world meets the real world.					X		X			
12	Knows where to look for and secure funding	Teacher is knowledgeable about funding opportunities. Teacher leaders must be able to locate monies and funding agencies to support proposed plans. Teacher builds and modifies a list of funding sources. Teacher talks with colleagues, professional organizations, administrators, and business people to publicize and increase the list. Teacher helps other teachers find funding sources for projects.								X		
13	Takes risks	Teacher tries new projects. Teacher gives students the benefit of the doubt, opens up the classroom to parents, colleagues, and mathematics professors. Teacher asks students how instruction may be improved.								X	X	

Attributes & Actions to Improve Mathematics Teaching & Learning

In this section, I address the above attributes and what measures mathematics teacher leaders can take to help themselves and colleagues improve their teaching to create a mathematics reform classroom environment. I will use the phrase mathematics teacher leader at times and simply teacher leader at other times. It is important to note that I am always referring to a mathematics teacher leader, but do feel that many of these comments apply to teacher leaders in other content areas as well.

First, mathematics teacher leaders are called to be both mathematical content experts (attribute 1) and mathematical pedagogical content experts (attribute 2). Mathematics teacher leaders can mentor teachers in these areas, taking university classes as well as professional development courses together. As many researchers have noted (Barth, 2001; Fullan, 2002; Lieberman & Miller, 2004; Miller et al., 2000), teacher leadership (and I would argue teaching as well) happens in collaborative groups. I see the role of the teacher leader to be to learn alongside mentees and colleagues. For instance, novice teachers and teacher leaders could be a part of weekly curricular groups allowing both to learn more deeply about the curriculum.

Second, I see cultivating teacher leaders (attribute 3) as one of the most important attributes. Teacher leadership is about striving for the benefit of the entire organization rather than an individual (similar to Fullan's idea of moral purpose). One person can only teach or lead for so long. It is the responsibility of that teacher leader to mentor and develop other teacher leaders. They must share what they know in order for cultivation to occur. For instance, the year before a mathematics department chair steps down, she or he serves as a co-chair with the new department chair. As co-chairs, the new chair works alongside an experienced colleague while also bringing new ideas to the role. Much like the old adage that you learn better when you teach, I would offer that you learn to lead better when you teach others to lead.

Next, attributes 4 and 6 call teacher leaders to look objectively at their practice and be members of a learning community. Teacher leaders invite teachers into their classrooms to observe their teaching, talk about strengths, and offer suggestions for improvement. For instance, teachers who are a part of the same curricular groups (mentioned above for attributes 1 and 2) choose a similar lesson to observe each other teaching. During the next curricular group meeting, the focus would be to discuss what everyone observed. Once teacher leaders open their classroom for constructive criticism in a spirit of improvement and quality teaching for students, then other teachers will feel more comfortable opening their classrooms for the same practice. Teacher leadership is not about "fixing the broken;" it is about lifting up and improving all teaching practice.

Fourth, trust (attribute 5) is a foundational piece to teacher leadership (Miles et al., 1988) and I believe, one of the most difficult to develop. For instance, before curricular group members observe one another, they should have a conversation around the apprehensions members have about opening their classroom. Although at times discussing apprehensions may be uncomfortable, the teacher leader must pursue these conversations. As teachers may initially feel uncomfortable sharing fears, the teacher leader generates a list or has members type concerns to discuss anonymously. To invite colleagues into a classroom to watch a very public, however very personal practice, trust must be central to that relationship. Trust in the sense that the teacher leader is present to genuinely help a teacher improve instruction for professional development as well as for the development of the children's learning in that classroom. Trust comes in when teachers also recognize that teacher leaders are not only interested in improving others' practice, but also their own practice. This recognition returns to the idea that teacher leadership is about improving the organization as a whole rather than simply individuals (Fullan, 2005).

Fifth, teacher leaders must believe all students can learn and all teachers can teach (attribute 7), advocate for students and teachers (attribute 8), and serve as a mathematics teacher ambassador (attribute 9). In order for teacher leaders to persist in teaching all students and working with all teachers, the belief must be present that everyone is capable of improving. That belief also provides the stamina teacher leaders need to advocate when they feel their attempts are failing. For instance, when a teacher is struggling with a class, a teacher leader provides support by observing and, at times, being an additional presence in the classroom. If a policy is proposed that will impact students, a teacher leader talks with students about the policy to find out what students think and then shares students' thinking with colleagues and administrators. As a mathematics teacher ambassador, teacher leaders can explain to stakeholders outside of mathematics education the impact

changes may have on students and teachers. For instance, if a reform-based curriculum is introduced, a teacher leader talks with students, parents, and the community addressing questions and concerns using understandable language devoid of educational jargon.

Sixth, teacher leaders understand the political nature of the classroom (attribute 10), have the capacity to create and execute action plans (attribute 11), and know where to look for and secure funding (attribute 12). These three attributes affect one another. Understanding the political nature of the classroom impacts a teacher leader's ability to execute an action plan. At times, action plans require funding. The political nature of the classroom means teacher leaders foster crucial relationships with students, parents, community members, and administrators. Teacher leaders take great care when talking with others, choosing words wisely, knowing the potential impact of their statements. A teacher leader may develop an action plan to make departmental meetings more curricular based. The first department meeting is devoted to developing strategies and listing potential challenges in executing such a plan. The department revisits the action plan throughout the year to discuss its success and modify if necessary. If an action plan requires funding, a teacher leader has a list of potential sources. Teacher leaders build a list of potential funding resources, such as local professional organizations as well as more national organizations, such as NCSM and NCTM. Teacher leaders share lists of resources with colleagues.

Finally, teacher leaders take risks (attribute 13). These risks can be in the form of trying out a new curriculum, opening up the classroom for others to visit, critically investigating practice through teacher research, or candidly talking with students about how instruction may be improved. For instance, if students are struggling with a mathematical concept, a teacher leader talks with students, as well as colleagues, about a different instructional approach they think may be helpful and implements the instructional approach. Discussion and dialogue continue to evaluate how the approach is working. Another example of a teacher leader taking a risk may be to enroll in a course in an unfamiliar area of mathematics. The course may not only challenge the teacher intellectually, but also remind the teacher of how it feels to be a student of unfamiliar mathematics.

Concluding Remarks

In 1983, *A Nation at Risk* transformed education into a national agenda with a political nature. The Carnegie Task Force answered *A Nation at Risk* with the NBPTS and NCTM responded to the 1983 report with the *Professional Standards for Teaching Mathematics* (1991). Both documents outlined what teacher leaders should look like and do. Further research has expanded those initial attributes and will continue to do so. I have taken the present research and used it to inform my own list of attributes and actions creating a profile of a mathematics teacher leader and how those attributes can help teachers improve the reform mathematics environment in their classrooms. Without the guidance of effective mathematics teacher leaders, reform efforts will be difficult to implement. Teachers need to work together to fully recognize the power of reform efforts.

As the field of teacher leadership grows, future research will add to the existing literature, specifying the difference and unique attributes of teacher leaders in content areas, such as mathematics and science. Future research is needed to help translate current research into more profiles like the one above. Practicing teachers need to see teacher leader profiles in practitioner terms (translated from the research) to enable them to enact the attributes in their schools and classrooms. And finally, more research is needed to see how teacher leaders are affecting change in their schools and how, ultimately, that change translates into improved student achievement.

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APPENDIX A

The Five Propositions of the National Board for Professional Teaching Standards

Proposition #1: Teachers are committed to students and their learning.

- Teachers recognize individual differences in their students and adjust their practice accordingly.
- Teachers have an understanding of how students develop and learn.
- Teachers treat students equitably.
- Teachers' mission extends beyond developing the cognitive capacity of their students.

Proposition #2: Teachers know the subjects they teach and how to teach those subjects to students.

- Teachers appreciate how knowledge in their subjects is created, organized and linked to other disciplines.
- Teachers command specialized knowledge of how to convey a subject to students.
- Teachers generate multiple paths to knowledge.

Proposition #3: Teachers are responsible for managing and monitoring student learning.

- Teachers call on multiple methods to meet their goals.
- Teachers orchestrate learning in group settings.
- Teachers place a premium on student engagement.
- Teachers regularly assess student progress.
- Teachers are mindful of their principal objectives.

Proposition #4: Teachers think systematically about their practice and learn from experience.

- Teachers are continually making difficult choices that test their judgment.
- Teachers seek the advice of others and draw on education research and scholarship to improve their practice.

P**roposition #5: Teachers are members of learning communities.**

- Teachers contribute to school effectiveness by collaborating with other professionals.
- Teachers work collaboratively with parents.
- Teachers take advantage of community resources. (NBPTS, 2005)

APPENDIX B

NCTM Professional Standards for Teaching Mathematics

Standards for Teaching Mathematics:

Standard 1 Worthwhile mathematical tasks
Standard 2 The teacher's role in discourse
Standard 3 Students' role in discourse
Standard 4 Tools for enhancing discourse
Standard 5 Learning environment
Standard 6 Analysis of teaching and learning

Standards for the Evaluation of the Teaching of Mathematics:

Standard 1 The evaluation cycle
Standard 2 Teachers as participants in evaluation
Standard 3 Sources of information
Standard 4 Mathematical concepts, procedures, and connections
Standard 5 Mathematics as problem solving, reasoning, and communication
Standard 6 Promoting mathematical disposition
Standard 7 Assessing students' understanding of mathematics
Standard 8 Learning environments

Standards for the Professional Development of Teachers of Mathematics:

Standard 1 Experiencing good mathematical teaching
Standard 2 Knowing mathematics and school mathematics
Standard 3 Knowing students as learners of mathematics
Standard 4 Knowing mathematical pedagogy
Standard 5 Developing as a teacher of mathematics
Standard 6 The teacher's role in professional development

Standards for the Support and Development of Mathematics Teachers and Teaching:

Standard 1 Responsibilities of policy makers in government, business, and industry
Standard 2 Responsibilities of schools and school systems
Standard 3 Responsibilities of colleges and universities
Standard 4 Professional organizations' responsibilities (NCTM, 1991)