A Continuum of Secondary Mathematics Teacher Leadership

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Abstract
The phrase "teacher leadership" has been used for over thirty years; however, a clear definition for teacher leadership is still under debate (Andrews, 1974; Murphy, 2005). Discussions focusing on mathematics teacher leadership are beginning and because teachers play a large role in the teaching and learning of mathematics, mathematics teachers need to be asked their views on teacher leadership (NCTM, 1991; Even, 1999; Nesbit, Wallace, Pugalee, Miller & DiBiase, 2001). Secondary mathematics teachers participated in a one year study after graduating from a masters of education program for experienced teachers in secondary mathematics education with the research question: *How do secondary mathematics teachers define, perceive, and enact teacher leadership?* Findings showed that teacher definitions broadened throughout the year. More importantly, a continuum emerged based on teacher perceptions and enactments with participants falling into categories along the continuum. With the teaching and learning of mathematics becoming a global conversation (Stigler & Hiebert, 1999), this study informs mathematics educators concerned with teacher preparation and development.

Introduction

In this paper, I begin with a short literature review of relevant literature followed by a brief description of the study context and design. I then share the teacher leader continuum that emerged and describe specific examples where teachers fell along the continuum. I close with an explanation of how this continuum contributes to the international conversation of mathematics education.

Literature Review

In 1981, U.S. Secretary of Education T. H. Bell created the National Commission on Excellence in Education (NCEE) to prepare a report on the state of education. In 1983, the commission presented *A Nation at Risk: The Imperative for Educational Reform*.

> If an unfriendly foreign power had attempted to impose on America the mediocre educational performance that exists today, we might well have viewed it as an act of war. As it stands, we have allowed this to happen to ourselves. We have even squandered the gains in student achievement made in the wake of the Sputnik challenge. (NCEE, p. 2)

The report further specified that "on the positive side is the significant movement by political and educational leaders to search for solutions--so far centering largely on the nearly desperate need for increased support for the teaching of mathematics and science" (NCEE, 1983, p. 20).

In response to *A Nation at Risk*, the National Council of Teachers of Mathematics (NCTM) published the *Curriculum and Evaluation Standards for School Mathematics* in 1989 and the *Professional Standards for Teaching Mathematics* in 1991. In 2000, the NCTM revised these documents publishing the *Principles and Standards for School Mathematics*. The *Professional Standards for Teaching Mathematics* (1991) was written based on two key assumptions:

1. Teachers are key figures in changing the ways in which mathematics is taught and learned in schools.
2. Such changes require that teachers have long-term support and adequate resources. (p. 2)

Teacher Leadership. As the broader definition of leadership is evolving from an individualistic definition to a more participative the educational definition of leadership is also changing. In the past, school leader referred to the principal; now, school leadership has broadened to include teachers as well. Just as principals are being called to be more instructional leaders, teachers are being called to be "high-quality teachers" (NCLB, 2001, p. 41).

Researchers agree on characteristics seen in teacher leaders. Many agree on the importance of building trust among colleagues and being a part of a learning community (Miles et al., 1988). Also, many mention the importance of understanding how organizations work and the political arena within which schools operate (O'Connor & Boles, 1992). Several researchers mention the understanding of the change process and the willingness to take risks as key components to teacher leadership (Lieberman & Miller, 2004; Fullan, 2002).

Mathematics Teacher Leadership. In 1991, the NCTM's publication of the *Professional Standards for Teaching Mathematics* was an attempt to set a national precedent for how "good mathematics teaching" is enacted to help students, teachers, parents, administrators, teacher educators, and policy makers "see" high quality teaching. With the publication of these standards, the conversation regarding high quality mathematics teaching became possible.

Similar to the literature on teacher leadership, this body of literature also finds that teacher leaders must build relationships and understand the change process (Miller et al., 2000). More specifically, this body of literature focuses on the teacher leader's expertise of mathematics and the mathematics classroom (Langbort, 2001; Webb, Heck, & Tate, 1996). In her list of *Who are Teacher Leaders?*, Langbort (2001) 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. As active members in the mathematics community, teachers participate in self-identified professional activities and extend further beyond formal professional development activities such as peer observation (Webb et al., 1996).

Study Context

Twelve secondary mathematics teachers were followed for one year to explore the research question: *How do secondary mathematics teachers define, perceive, and enact teacher leadership?* All twelve were graduates of a Masters of Education (M.Ed.) program. The two-and-a-half year M.Ed. program is tailored for full-time teachers. The program is both a distance education program, where classes meet away from the university campus in area schools, as well as a hybrid program, where courses meet face-to-face and online. The M.Ed. program had several content specialty areas including K-12 literacy and 6-12 social studies running concurrently with the 8-12 Mathematics. A total of 56 students were enrolled from all three specialty areas. The program has a core set of courses that all students take regardless of specialty area. In addition, each specialty area students take content specific courses. The program has three guiding foci: teacher as content specialist, teacher as researcher, and teacher as change agent. These three foci are woven throughout the program courses with the first course entitled *Reinventing Teaching* and the final course entitled *Teacher Leadership and Democratic Schooling*.

My role in the M.Ed. program began in the fall of 2003, after the students had completed the first summer session. For the remaining two years of the program, I served as the cohort teaching assistant including a variety of roles including co-teaching courses, supporting the cohort members in administrative needs such as registering, providing feedback on course

assignments, and scoring final portfolios. Starting in the fall of 2003, I served as the teaching assistant for every course taken by the students.

Study Design & Analysis

The one-year in which the study took place was an academic year, beginning in June and ending in May as seen in the Table 1. The predominantly qualitative data was analyzed in seven phases. Participants completed a Teacher Leader Narrative addressing the prompt: *Write a story about teacher leadership*. The participants then completed a Teacher Leader Pre-Survey. A scaffolded analysis was completed meaning that initial data analysis occurred after each phase to inform the next phase. For example, the Teacher Leader Narrative was coded and the Teacher Leader Survey results were tallied. These codes and tallies informed the question development for the First Interview Protocol. Then, participants completed three individual interviews during the year (phases 2, 4, and 6) as well as two focus groups (phases 3 and 5). Each interview and focus group was recorded, transcribed, and coded. Member checking was employed as each interview transcript was emailed to each participant for correctness and clarification. During subsequent interviews and focus groups, participants were asked to clarify unclear points and to assess evolving findings. Finally, the participants completed the Teacher Leader Post-Survey.

Table 1. Data Collection Phase Timeline

Phase	Timeline	Data collection method
1	June	Teacher Leader Narrative
	July	Teacher Leader Survey (Pre)
2	September	Interview #1 (Twelve teachers)
3	November	Focus group #1 (Two groups of six teachers and four teachers)
4	January	Interview #3 (Twelve teachers)
5	March	Focus group #2 (Two groups of three teachers each)
6	May	Interview #3 (Twelve teachers)
7	May	Teacher Leader Survey (Post)

Findings: Teacher Leader Continuum

Throughout data analysis, a teacher leader continuum emerged that captured teacher perceptions and enactments of teacher leadership. In this section, I present the continuum (Figure 1) and then offer examples from selected participants that demonstrate how each teacher fell on the continuum.

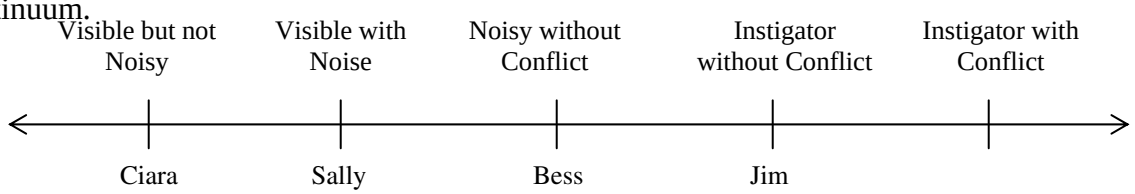

Figure 1. Teacher Leader Continuum

It is imperative to make three key points before proceeding. First, the continuum is not value-laden; neither the teachers nor I believe that one position along the continuum is better than another. Secondly, the continuum is "situational." Whereas a teacher may typically fall on one position along the continuum, situations may arise that cause the teacher to move to another position along the continuum. Third, "noisy," "instigator," and "conflict" usually have negative connotations. The reader of this paper is asked to suspend those negative connotations. Great thought and discussion surrounded the decision to include theses words in the continuum headings. While other, less potent words were considered, I decided to return to these words, the original words of the teachers, to maintain the integrity of the data. The following five sections present specific examples from teachers who fell into each category.

Visible but not Noisy. After 18 years of teaching in the same county and school, one teacher in the study, Ciara, finds herself at a new school in a new state. Ciara comes from a state where graphing calculator use was foundational in mathematics classrooms. Ciara's new school does not use calculators in the Algebra 1 classroom. Although Ciara has sent a few emails to her department chair about calculators, Ciara has decided to remain quiet, at this point, about her views on the importance of calculator use. She does not want to alienate herself from her colleagues but also wants to provide the best mathematical instruction for her students. She is working to set an example by using calculators in her own classroom but not creating barriers with her colleagues by saying, "Where I come from, we do it this way." She is gathering research about calculator use in preparation for a day when her colleagues begin to ask questions about what she is doing in her classroom.

Visible with Noise. Sally teaches in a large urban school district where two mathematics curriculums are taught. One curriculum is more traditional while the second curriculum is reform-based. The district wanted all schools to teach the same traditional mathematics curriculum. Sally's school taught a reform-based curriculum and data showed that it worked well for their students. When the district began to push for the uniform traditional curriculum throughout the district, two teachers who fall in the Instigator creating Conflict category collected data from mathematics departments to show the success they found with the reform-based curriculum and why it worked best for their students. Initially, Sally was happy to give her data but did not feel comfortable speaking up. As the year and discussion progressed, Sally began to speak up a bit more about why she felt the reform-based mathematics curriculum should be continued in her school.

Noisy without Conflict. Bess has a strong desire for equity in mathematics instruction. In her mathematics department meetings, she generated discussion around a block-scheduled algebra class that was designed to last two consecutive 55-minute periods and targeted at students who typically struggled in Algebra I. She knew Algebra I was a gatekeeper for students in reaching higher-level mathematics. When the department agreed to offer the course, no one volunteered to teach the course so Bess took on the challenge of both developing and teaching the new Block Algebra course.

Instigator without Conflict. Jim teaches in a small suburban school district near a university. Therefore, the student population, in general, is strong academically. The state where Jim teaches recently began offering different levels of diplomas. To earn a level four diploma, students must complete four years of mathematics. The highest level of mathematics offered at Jim's school is calculus. "I always envisioned that I would be teaching seniors Calculus. I never envisioned my classroom being sophomores." So as sophomores complete the highest level of mathematics available, no other high school mathematics course exists for them

to take and therefore, will not be able to graduate with a level four diploma. The glitch in the new diploma system has yet to be rectified although Jim has told his district supervisor of the problem. As a result, Jim has had to "call in every favor I ever had with the [university] math department." While working to help the state modify this requirement for students who complete all possible high school mathematics courses early, Jim is working with the university to create an afternoon section appropriate for high school students. Jim has not only worked with his own school but also the other high schools in the district and state to coordinate efforts to benefit students. Jim did not create the conflict but is being reactive and vocal in trying to resolve it.

Instigator with Conflict. No teachers in this study fell into this category but many talked about colleagues in this category. The key difference between the fourth and fifth position is that teachers are more reactive in the fourth position and more proactive in the final position. In the fourth position, teachers deal with actions that are already in existence. In the fifth position, teachers are creating causes based on their own passions and drive to see a change. In Sally's district, two teachers decided to take action when the district decided to have all schools teach the same traditional mathematics curriculum. They had data to prove that the reform-based curriculum they were using worked best for their students. They gathered data from other schools and convinced the district to not change their curriculum. One final example illustrates a non-negative conflict as well as the situational nature of the continuum. Ciara has a passion for teacher research so in addition to her wanting to use calculators in her class, she has also brought another opportunity for professional development to her school. She is being an instigator of teacher research, a positive conflict that has the potential to improve teacher practice.

Continuum Contributions to the International Conversation

Strong mathematics education is a desire of many countries (Even, 1999; Stigler & Hiebert 1999). Strong teachers are needed to improve mathematics instruction (NCTM, 1991). This teacher leader continuum offers a framework with which to begin a conversation on how to utilize secondary mathematics teacher leaders. I suggest the continuum be used in two ways. First, the continuum offers concrete descriptions with which to discuss teacher leadership. Mathematics educators can use the continuum to assess what types of teacher leaders are active in their schools. Secondly, the continuum can allow mathematics educators to see which categories along the continuum are deficit, meaning what types of teacher leaders need to be better developed to create a balanced array of teacher leaders in our schools.

In conclusion, I recognize that mathematics classrooms and teachers have different challenges throughout the world and I do not naively believe that what works in one place will work the same in another. I do, however, believe that the continuum produced from this research can provide a place to begin, internationally, for mathematics educators to think more deliberately about who mathematics teacher leaders are, how to develop them, and how best to use their expertise to improve mathematics education for all students.

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