

Journal of Mathematics Education at Teachers College

Spring – Summer 2013

A CENTURY OF LEADERSHIP IN
MATHEMATICS AND ITS TEACHING

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Teachers College Columbia University
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Leadership From Within Secondary Mathematics Classrooms: Vignettes Along a Teacher-Leader Continuum

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The purpose of this article is to present five examples of teacher leadership from within secondary mathematics classrooms. These vignettes come from a larger study that resulted in a teacher-leader continuum. This article offers classroom teacher examples that highlight each of five positions along that continuum. The argument is made that a wide array of secondary mathematics teacher leaders are needed to improve the teaching and learning of mathematics for all students.

Keywords: teacher leadership, secondary mathematics, mathematics education

Introduction

The phrase “teacher leadership” has appeared in the literature for over thirty years (Andrew, 1974; Rogus, 1988; York-Barr & Duke, 2004; Zimpher, 1988) with little consensus on a distinct and unified definition. The phrase “teacher empowerment” has sometimes been used to describe a similar phenomenon (Marks & Louis, 1997). Teacher leaders already exist in our schools in more traditional roles such as grade level chairs, department chairs, and curriculum developers. Less traditional teacher leader roles are constantly being developed; these roles are those such as leaders of teacher research inquiry groups in their schools and co-leaders of lesson study projects in a district (MacLean & Mohr, 1999; Stigler & Hiebert, 1999). Schools are realizing traditional roles and designs of schooling need to evolve in order for schools to work for all children. Similarly, the teaching profession must realize that traditional roles and designs of teaching need to evolve in order for schools to work for all teachers. As Pellicer and Anderson (2001) state, “Without question teacher leadership is more important today to the success of America’s schools than it has ever been before” (p. 1).

Coupled with a variety of existing understandings and definitions of teacher leadership, many variations of what a teacher leader does exists in schools. Some schools employ general curriculum resource teachers (and call them teacher leaders) who were once classroom teachers but now work with all classroom teachers full-time to develop and improve curriculum. Some schools employ mathematics and science coaches (and call them teacher leaders) who were once classroom teachers and now work with the mathematics and science teachers to improve curriculum and instruction. This article uses the phrase “teacher leader” to describe secondary mathematics teachers who are full-time teachers teaching

students while also impacting colleagues and policies outside their classrooms.

Secondary Mathematics Teacher Leadership

As the literature on teacher leadership has grown over the years, some researchers are beginning to concentrate on teacher leadership within content domains. *Professional Standards for Teaching Mathematics* (NCTM, 1991) set a national precedent for “good mathematics teaching” to help students, teachers, parents, administrators, teacher educators, and policy makers “see” high quality teaching. Similarly, the National Board for Professional Teaching Standards (NBPTS, 2002) offers an additional advanced secondary mathematics certification for teachers (Adolescent and Young Adulthood Mathematics). This process allows teachers to showcase “what teachers should know and be able to do” so that those who successfully earn certification become teacher leaders in the field.

More literature is focusing on the teacher leader’s expertise of mathematics and the mathematics classroom (Yow, 2007; Yow, 2010; Langbort, 2001; Miller, Moon, & Elko, 2000; NCSM, 2008; 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). Miller et al. (2000) offer guidance specifically to mathematics and science elementary school teacher leaders. In 2008, the National Council of Supervisors of Mathematics published the PRIME

Leadership Framework, detailing their vision for leadership in mathematics education.

A Secondary Mathematics Teacher-Leader Continuum

With the need for research more focused on secondary mathematics teacher leadership, the author conducted a study (Yow, 2010) that addressed the research question *How do secondary mathematics teachers define, perceive, and enact teacher leadership?* Findings from this year-long qualitative study of 12 full-time secondary mathematics classroom teachers resulted in a secondary mathematics teacher-leader continuum (Figure 1). This continuum was developed from 12 teacher leader narratives, 36 one-hour interviews, four focus groups, and 12 pre- and post-teacher leader surveys. The teachers had recently completed a masters program in secondary mathematics with a focus on teacher leadership. The continuum and rubric captured the descriptions of what these teachers saw as teacher leadership both in themselves and in their colleagues.

Secondary Mathematics Teacher Vignettes

Each of the 12 teachers was placed into one of the five positions across the continuum. For this article, the author has selected one teacher from each continuum position to include as an illustration of what a secondary mathematics teacher leader looks like within that position.

Visible but Not Noisy: Ciara

Ciara defines a teacher leader as

an expert in her content area, a life-long learner who understands and practices the associated pedagogy, who is a role model in her community and shares her knowledge of excellence and equity in an ethical and respectful manner. Teacher leaders are defining or articulating where a change needs to take place, recognizing, defining and then articulating. And then carefully approaching the situation so that the positive change occurs. But it has to be a methodical kind of process thing and has to recognize that different things call for different actions¹.

After close to 20 years teaching in one state, Ciara relocated to a different state. She finds herself working in a new environment with mathematics teachers who do not share her same thoughts on teaching. Coming from a school where graphing calculators were used to enhance instruction, Ciara moved to a school where graphing calculators are not

used. She is working to set an example by integrating the technology she has in her classroom but not creating barriers with her colleagues by saying

Where I come from, we do it this way. I believe if you quietly and subtly do what you do best, people will slowly look at you and say, maybe not directly, but they might think you might be somewhat of a leader . . . one of my goals is to show them that graphing calculators are pretty beneficial in Algebra 1 classrooms. It's about making our kids better students and better learners.

Ciara is also gathering research on the integration of graphing calculators into mathematics classrooms to share with administrators when she feels it is appropriate and will be well received.

Ciara has not considered herself a teacher leader but when she does, considers herself on the *quiet side*. As illustrated by the graphing calculator example, Ciara sees this issue as important for high quality mathematics instruction. However, she is choosing to work from inside her classroom initially to demonstrate success so that when she begins to present the ideas to her colleagues and administrators, they have already seen firsthand evidence of success in her classroom. Ciara has already been asked by her principal to present to faculty on the value of action research in hopes to help teachers learn about this form of research as a meaningful alternative to the traditional annual professional growth plans.


Visible with Noise: Sally

Sally defines a teacher leader as *one who works with teachers, parents, administrators, and policy makers to improve the status of education*. A deep belief in the teacher leader's responsibility to share her reflections on her own practice also encompasses Sally's definition, not only seen in her new department chair responsibilities, but also in her desire to share her knowledge. Having taught for eight years, Sally wanted to become a better teacher by enrolling in the masters program but did not want to stop teaching to do so.

Sally admits that she is an *all or nothing person*. She either puts in 100% or none at all. She earned National Board certification the first year of the program and serves as the department chair for her mathematics department (a position she was assigned as a second year teacher). This year, the role of department chair has taken on new responsibilities. Sally has been charged not only to handle administrative duties, but also to have more pedagogical discussions during department meetings. Her district has asked her to use email for administrative tasks as much as possible and to spend more time during meetings talking about teaching. Sally is both excited and *apprehensive* about her new role. As an

¹ *Italicized text* indicates direct quote from the teachers in the study.

LEADERSHIP FROM WITHIN SECONDARY MATHEMATICS CLASSROOMS



Visible but not Noisy	Visible with Noise	Noisy without Conflict	Instigator with Conflict	Instigator creating Conflict
Trying to find place in mathematics teaching and learning dialogues, sometimes at a new school	Prefers to be quiet in mathematics teaching and learning dialogues but will speak up if forced	Is diplomatic in garnering support for mathematics educational issues	Is not afraid of being labeled for being loud in mathematics teaching and learning dialogues but aware of stigma attached	Is proud of being labeled loud in mathematics teaching and learning dialogues
Sees self as part of larger mathematics education group; often mention others as mathematics teacher leaders	Wants to be involved in mathematics teacher leadership but feels pulled away from teaching	Is sensitive to different perspectives of other mathematics teachers and teacher leaders	Has newfound agency as a mathematics teacher leader and feels a responsibility	Considers self as mathematics teacher leader and acts
Likes to be behind the scenes in mathematics education	Actions seen as teacher leadership by other mathematics colleagues	Makes sure voice is heard in mathematics education discussions	Will stand against or for action based on its harmfulness to mathematics students and/or teachers	Creates a mathematics teaching and learning cause towards which to work (more proactive than reactive like “with conflict” previously)
Works to guide other teachers in mathematics teaching and learning in schools	Works to guide other teachers in mathematics teaching and learning in schools	Works to represent mathematics teachers in the school and district	Works to protect mathematics teachers and/or students from unfair policy in the school, district, and state	Works to protect mathematics teachers and/or students from unfair policies in the school, district, and nation

Figure 1. Teacher Leader Continuum & Rubric. Modified from (Yow, 2010)

eight-year veteran, Sally feels like she does have wisdom to share with her colleagues. However, she also recognizes that many of her colleagues have just as much if not more experience than she has and feels awkward entering their classroom and giving them feedback on their instruction.

And for me to go in and say to them, Let’s think about this. Some of them are open to it. They’ve said to me, I understand your new role and I’m open to it. And then other people are set in their ways and that’s a big obstacle to me is dealing with, as a teacher leader; other teachers who themselves are teacher leaders.

Sally sees herself as a mathematics teacher leader *because people see me as one, if that makes sense. I see myself as a teacher leader because other people see me as one. Other people, they see me as somebody who they can come to with questions and concerns about stuff whether it’s planning a lesson or dealing with students or policies or whatever it is.* If asked for a response, Sally, *not to sound conceited, but [her response] will probably be a good response, well thought*

out and knowledgeable—an intelligent response. She offers her opinion when asked but does not want to be seen as outspoken or argumentative.

Sally has found limited success with having departmental meetings more focused on meaningful mathematics teaching and learning discussions and less on administrative tasks. The first-of-the-year meetings included fruitful discussions about what mathematical topics on teaching and learning they would discuss throughout the year, but as the year progressed, *administrative and business stuff started leaking in.* Even with the leakage, Sally sees the push to have more meaningful discussions in department meetings as positive (Yow, 2008) and a means for infusing teacher leadership into her own practice and that of her colleagues.

Noisy without Conflict: Bess

According to Bess, *teacher leadership involves courageously making positive changes in the lives of students and their parents, making positive changes in the lives of*

teacher, and advancing education for the better at the district, state, national, and international levels. Evident from her comments, Bess believes in emphasizing the positive in all situations. Her largest frustration is the *tendency for teachers to feel like victims all the time. I just have no patience for that. And yes I realize we have a lot on our plates, but I hate people going around feeling like victims all the time. They just feel so sorry for themselves sometimes they just feel incapacitated, they can't function.*

Bess does consider herself a teacher leader, although she sees it as an identity that has come over time.

I think some of that has just been over time. I don't think when I first started teaching I was a teacher leader. I was a good teacher, maybe, but I don't think I was a teacher leader. And I don't know how that happened—it just sort of evolved. I think part of it was being willing to take on responsibilities that were not necessarily a part of being a teacher and some of that came with age and time. I think some of it came after I have stayed in the building; I'm not going anywhere. And I think people know that. I'm not just a fly-by-night.

After teaching for three years at a small rural middle school, she made the move to a larger urban high school currently in her twelfth year of teaching. Two of her most recent mathematics teacher leader tasks have included serving on the Superintendent's Advisory Council (SAC) and co-teaching a new algebra class for special needs students. Her role as a member of SAC puts her in direct contact with the district superintendent on the monthly basis and includes the challenge of *representing a faculty that I don't always agree with, so I try my best to represent them to the best of my ability the way they want me to represent them but at the same time to be true to myself.* She advocated for and agreed to pilot a new algebra class exclusively for students with special needs that she co-teaches with a special education teacher. After over a year of campaigning, the school agreed to allow Bess to teach the course every day over a two block period to allow the time needed to delve deeply into the mathematical content with the students. Bess has found a way to lead by making noise about goals of which she is passionate about while also working to build trust and relationships with colleagues (Lieberman & Miller, 2004; Miles, Saxl, & Lieberman, 1988) that decreases the amount of conflict involved in reaching those goals that, ultimately, improve the teaching and learning of mathematics for all students. *You can't bully your way into change, so you have to build rapport, build relationships, and then through that process engender change.*

Instigator with Conflict: Jim

Jim initially defined a mathematics teacher leader as *someone who advocates for the rights and working/learning conditions of teachers and students. This can be done at the classroom, school, district, state, or national level.* He sees teacher leaders as individuals who need to *lead by example* and take an *active role*. Teacher leaders need to be *willing to be outspoken* and *walk the walk as well as talk the talk*.

Jim never considered himself a mathematics teacher leader before completing the masters program, even though he serves as the mathematics department chair. Upon completion of the program, he had a newfound sense of both responsibility and empowerment to utilize his assets as a high school mathematics teacher. Upon being asked if he considered himself a teacher leader, Jim responded:

I like to think so. I never really thought so. If you had asked me that before we started this whole program, I would have said no. Absolutely no. Even though I do a lot of the same things, I don't think I would have ever really thought about it because I'm envisioning the teacher leader as the one lobbying outside the state department: they're doing this and they're doing that. I see that it takes on a different role.

An example of Jim's teacher leadership has been the result of another challenge in his district. In order to graduate from his high school and be eligible for acceptance into a four-year university, 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, 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 being *proactive* and has worked with the university mathematics department to create an afternoon section specifically geared towards these high school students. Jim has not only worked with his own school but also the other high schools in the district to coordinate efforts to benefit students from the entire district.

Similar to the course requirement dilemma that is negatively impacting his students, Jim is not afraid to raise issues he sees as important to the teaching and learning of mathematics. Jim offered another example where a mathematics teacher in his department was being *unfairly targeted* by his administration to be fired based on what they perceived as ineffective teaching practices. He, along with other members of his department, offered a collective *loud voice* by gathering data on student achievement and outside

research to support their colleague's teaching practices as effective mathematics pedagogy. *They cared enough about an issue to not just complain about it. They did something about it. I think that's what teacher leaders are doing to make the profession better.* Jim does not shy away from instigating actions, *proactively*, to champion important issues that impact the teaching and learning of mathematics.

Instigator Creating Conflict: "Sarah"

"Sarah" has her name in quotes because she did not exist, at least as a participant, in this study. None of the 12 teachers involved in this study were placed at this position along the continuum. However, several of the participants talked about "Sarah" as a teacher leader with whom they worked or had seen demonstrating mathematics teacher leader characteristics, so "Sarah" is described here based on the data gathered from the participants.

Only one word delineates the fourth category on the continuum of "Instigator **with** Conflict" and this final category, "Instigator **creating** Conflict." Although small, this one word difference is important in that teacher leaders like Jim do not avoid the conflict involved in an issue they feel impacts the teaching and learning of mathematics. Teacher leaders like "Sarah," however, may, in a sense, create the conflict needed to improve the teaching and learning of mathematics for all students.

For example, "Sarah" was a mathematics teacher leader at a school in the same large urban district as several of the teachers who participated in this study. That district was in the midst of a discussion to mandate the same mathematics curriculum at all schools, which was not the standards-based curriculum that was currently being used successfully at several schools in the district. Rather than quietly proceed with the district-level decision, "Sarah" along with several of her colleagues gathered longitudinal data on their student performance while using the standards-based curriculum and presented their findings to the district. They also included findings from fellow teachers around the nation who were also using this curriculum. While the district has yet to make a final decision on the mandated curriculum, the work of "Sarah" and her colleagues influenced the district to take more time to evaluate their decision of mandating a district-wide mathematics curriculum. "Sarah" was not afraid to be labeled loud and collectively voiced teacher claims, supported by data, for what was best for their students in mathematics.

Discussion and Implications

These five vignettes offer five different examples of mathematics teacher leaders who embody a variety of strengths and characteristics but who all work to improve the

teaching and learning of mathematics for all students both inside and outside of their classroom. All types of teacher leaders are necessary. The continuum is not value-laden with one position being more important than another. Inherent in the fluid nature of a continuum and exhibited by teachers in this study, different situations can move teachers to different positions along the continuum.

Neither gender nor years of experience seemed to affect the position of a teacher along the continuum. Although a male was used as the example of the Instigator with Conflict in this article, males also appeared in the Visible but not Noisy position. Similarly, like Ciara, some teachers in the Visible but not Noisy position had the most years of teaching experience, so it is not inherent that as teachers gain years of experience, they move along the continuum.

Implications from this work include offering a secondary mathematics teacher-leader continuum along with examples from actual classroom teacher leaders that can help mathematics teachers better evaluate where their strengths lie if they are interested in impacting the teaching and learning of mathematics outside the classroom. By the same notion, it offers examples to mathematics department chairs, mathematics coaches, mathematics district coordinators, mathematics teacher educators, and administrators of what teacher leadership from within a mathematics classroom looks like. By having this continuum and teacher examples, mathematics departments can be opened to provide spaces for a variety of teacher leadership styles. Mathematics district coordinators can better identify teacher leaders within their districts and capitalize on their strengths based on where they see them along this continuum. Mathematics teacher educators can better prepare future secondary mathematics teacher leaders to function effectively within their departments, schools, and districts by making them aware of these facets of leadership. By recognizing the strengths, variety, and potential for mathematics teacher leadership in our schools, classroom teachers who work the closest with learners can continue to impact and improve the teaching and learning of mathematics for all students.

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