Supporting the Development of Science Teacher Leaders – Where Do We Begin?

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Abstract

Teacher leadership has been recognized as a necessary ingredient to support educational reform efforts. Leaders provide the needed expertise to ensure reforms are successful in promoting student learning. The overarching goal of the *Leadership in Freshman Physics* program is to support a cadre of teachers-leaders who will become advocates for "Physics First" by developing their knowledge of physics content and research-based pedagogy. In order to support teachers in developing the knowledge, skills, and dispositions for effective leadership, it is important to first understand their initial views of teacher leadership and their prior leadership experiences. In this paper we present results from the initial phase of our multi-year research study in which we examine teacher' past leadership experiences, definitions of teacher leadership, and views of themselves as leaders. Participants include a cohort of 36 teachers participating in the program, each of whom has committed to teaching a year-long freshman physics course at their school. Our findings indicate teachers' definitions of leadership are relatively narrow, and often confined to formal leadership roles. Though teachers participate in numerous leadership activities, they don't explicitly consider these to be leadership. Implications for addressing teachers' conceptions through professional development are shared.

Problem

Teacher leadership is "the process by which teachers, individually or collectively, influence their colleagues, principals, and other members of school communities to improve teaching and learning practices with the aim of increased student learning and achievement" (York-Barr & Duke, 2004, p. 288). As such, teacher leadership is a necessary ingredient for educational reform. Effective leadership provides a catalyst for change, and is essential to implementing and sustaining curriculum reform efforts (Larkin, Seforth, & Lasky, 2008). Leaders provide the needed expertise to ensure reforms are successful in achieving their intended effect—promoting student learning. National Science Foundation's Math and Science Partnerships (MSP) program recognizes the importance of teacher leadership to the success of reform efforts. The MSP *Teacher Institutes for the 21st Century* specifically focus on "meeting national needs for teacher leaders/master teachers who have deep knowledge of disciplinary content for teaching and are fully prepared to be school- or district-based intellectual leaders in mathematics or the sciences" (NSF, 2010).

Supporting the development of teacher leaders is a critical issue for professional developers in MSP programs. Despite the recognized importance of teacher leadership, little is known about how teachers learn in practice to become teacher leaders (Liebermann & Miller, 2005). Indeed, the culture of schools and norms of the teaching profession may actually be counterproductive to supporting the development of teacher leaders. For example, norms of equity, privacy, and autonomy serve as barriers to leadership that involves exchanging advice and interacting with colleagues (Smylie, 1992). Thus, in undertaking efforts to support teacher leaders, understanding teachers' own perceptions of leadership and professional norms is an essential first step. *Leadership in Freshman Physics* is an NSF funded MSP that is designed to support 9th grade physics teachers in leading curricular reform efforts in their districts. The purpose of this study is to explore participating teachers' ideas about leadership, activities they consider to fall in the realm of leadership, and how they perceive themselves as leaders within their classrooms and schools. Through examination of teachers' initial conceptions of leadership and

leadership experiences, we will provide insights into challenges professional developers may face, and suggestions for how they can differentiate program activities to support teachers in their development as leaders.

Theoretical Framework

Individual leadership capacity is the knowledge, skills, and dispositions that enable teachers to enact change within the affordances and constraints of the organizational context, with the specific purpose of improving teaching and learning. Leadership serves a variety of functions that support change (e.g., collaboration, building and communicating an instructional vision, life long learning, etc.), and is conducted within various dimensions of practice (York-Barr & Duke, 2004). Leadership functions are achieved through a host of interconnected tasks that are carried out by actors through both formal and informal means as schools undertake reform. As Darling-Hammond and colleagues explain,

> …in the course of restructuring, opportunities to collaborate and take initiative are available at every turn. The specific leadership responsibilities that evolve are not predetermined a priori but are varied, flexible, and idiosyncratic to individual school teams and their distinctive situations (Darling Hammond et al., 1995, p. 89).

The above supports the notion that not all teachers will demonstrate leadership in the same way or work within the same domains. In a review of findings from over two decades of scholarship on teacher leadership, York-Barr and Duke (2004) identified seven different dimensions of practice in which teacher carry out leadership activities. These include:

- Coordination and management
- School or district curriculum work
- Professional development of colleagues
- Participation in school change & improvement
- Parent and community involvement
- Contributions to the profession
- Preservice teacher education

In the present study, we use these as a framework to examine the ways in which teachers define leadership, the activities they consider to be leadership, and their prior experiences as leaders. Specifically, we focus on the following questions:

- How do teachers define leadership within their own professional contexts?
- In what ways do teachers perceive themselves as leaders?
- What kinds of activities do teachers consider to be leadership?

Context of the Study

The context of this study is an NSF-funded Math and Science Partnership (MSP) designed to support a cadre of teacher leaders to become advocates for excellence in physics content and research-based pedagogy. The program focuses on offering "Physics First", or shifting the traditional sequence in which coursework is offered in the high school. Participating teachers attend a summer academy, where they develop their understanding of physics and modeling pedagogy. The professional development (PD) also includes specific leadership-focused activities and academic year support for teachers to implement individualized action plans, through which they provide the necessary leadership for their schools to make the switch to offering physics at the freshman level.

All 36 teachers in the first cohort of the program consented to participate in the research. Of these, 18 (50%) were female. Years of teaching experience ranged from 1 to 18, with a mean of 4.3 years in the classroom (median of 3.5). The teachers hailed from 20 different school districts throughout the state, including both rural and urban areas. 13 had an undergraduate degree in education, while the

remaining had undergraduate degrees in a variety of other areas (e.g., chemistry, industrial engineering, biology, agriculture, animal science). Only 2 participants had an undergraduate degree in physics, specifically. All participants were certified to teach (with two holding temporary or provisional certificates) and 5 of the participants had achieved certification to teach physics prior to joining the program. 20 (55%) of the participants held master's degrees, which were all in areas other than physics (e.g., science education, administration, counseling).

Data sources

To address our research questions, we collected and analyzed multiple data sources. As part of the application process, teachers were asked to describe their prior leadership activities. At the start of the MSP program, a Teacher Leadership Inventory was administered. [Have an expert review; discuss face/construct validity] This program-specific instrument was designed to elicit teachers' ideas about varying aspects of teacher leadership. The inventory consisted of 30 items that covered various possible formal and informal leadership activities. Each of the 30 items falls within one of the seven dimensions of practice of teacher leaders (coordination and management, school or district curriculum work, professional development of colleagues, participation in school change and improvement initiatives, parent and community involvement, contributions to the profession of teachers, and preservice teacher education) summarized by York-Barr and Duke (2004). Teachers selected 'yes' or 'no' to the following questions about each item (a) Have you participated in this activity? and (b) Is this leadership? After completing of the inventory, teachers provided their definition of teacher leadership.

Analysis

Analysis included both quantitative and qualitative approaches, as described below.

Quantitative Analyses Deductive means were used to categorize teachers' self-reported leadership experiences and responses to the Teacher Leadership Inventory according to the seven dimensions of practice of teacher-leaders (York-Barr & Duke, 2004). We developed frequency tables and used these to generate profiles of teachers' leadership activities. Additionally, teachers' participation in and perspectives on leadership activities from the inventory were compiled into frequency tables to examine patterns and their relevance to teachers' views of leadership. For each of the seven dimensions of practice of teacher leaders, we calculated the percentage of teachers who a) participated in the activity and viewed it as teacher leadership, b) participated in the activity but did not view it as teacher leadership, c) did not participate in the activity but viewed it as teacher leadership, and d) did not participate in the activity and did not view it as teacher leadership. We then compared the seven dimensions in terms of the relative percentages of respondents in each category a) through d).

Qualitative Analysis We selected grounded theory as our analytic framework (Glaser & Strauss, 1967). In grounded theory, researchers are to develop sensitivity to existing theories, but then set aside existing theories in order to collect and analyze data with a fresh perspective (Strauss & Corbin, 1998). Initially, we analyzed teachers' definitions of leadership through open coding, or generation of low-inference codes that required little abstraction from the data. After initial coding, we developed categories through identification of redundancies, intersections, and hierarchal relationships between the initial codes. A careful review of the data enabled the identification of emergent themes, patterns, and structures. Typologies and classification schemes were constructed to organize themes and patterns, and to develop generalizations and propositions from the empirical data (Taylor & Bogdan, 1984). Data were connected within categories by constructing taxonomies. Spradley's (1979, in LeCompte, 2000) semantic relationships were used to organize items into meaningful structures.

Results

Quantitative Findings As part of the application process for the MSP program, teachers were asked to indicate their leadership experiences over the past 5 years. All but one of the 36 teachers reported prior leadership experience. We categorized teachers' responses in relation to the seven dimension of practice of teacher leaders (York-Barr & Duke, 2004) as shown in Figure 1. Of the 84 leadership experiences reported by teachers, the largest percentages (over 50%) were related to participation in school or district curriculum work, school improvement and professional development of colleagues. To a lesser extent (below 10%), their activities related to parent and community involvement. No teachers reported leadership activities related to preservice teacher education.
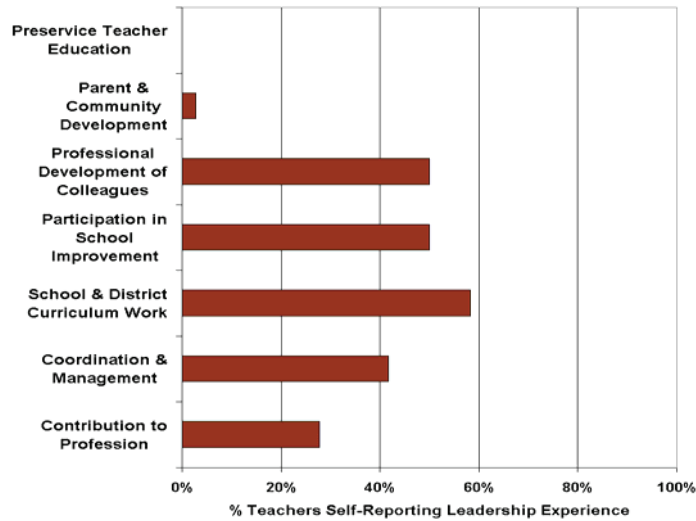

Figure 1. Teachers' Prior Leadership Experience in Various Domains
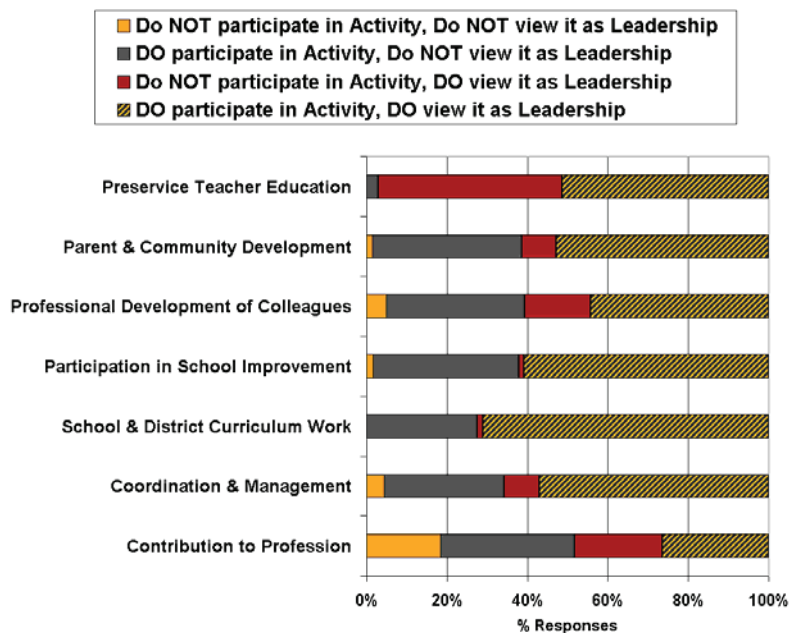

Figure 2. Teachers' Views of Leadership and Participation in Activities

Results of the Teacher Leadership Inventory reveal differences between what teachers participate in and what they view as leadership. Teachers report participating in many different kinds of leadership activities, but do not necessarily recognize themselves as leaders. For instance, over 95% of the respondents view preservice teacher education to be leadership, but only about 50% participate in it. Conversely, over 95% of the respondents participate in school improvement and curriculum work, but only about 60% view it as leadership. Of the differences between what teachers participate in and what they view as leadership, the exception is contribution to profession. Teachers approximately equally viewed or not viewed contribution to profession as leadership and have or not have participated in it.

Qualitative Findings

Teachers' definitions of leadership contained elements that fell into two major categories; leadership definitions both highlighted *personal qualities* of a leader (e.g., positive attitude, trustworthiness, selflessness, sensitivity, etc.) and the *knowledge and skills of leadership* (e.g., expertise, competence, decision-making skills, organizational and facilitation skills). 25% of teachers provided definitions that focused exclusively on one or the other category. 4 teachers defined leadership as personal qualities of an individual. For example:

> *I have heard from some persons that self motivation is leadership. In my opinion, leadership stems from within each person.*

In contrast, 6 teachers emphasized leadership exclusively as the knowledge and skills of an individual who leads. For example:

> *The ability to analyze/ decipher what improvement are needed and then use the available resource to work towards achievement of these improvements.*

Nonetheless, the majority (approximately 75%) of teachers provided definitions of teacher leadership that encompassed both of these elements, suggesting they view leadership as consisting of both knowledge/skills and dispositions/personal qualities. Individual codes comprising each of the two major categories are provided in Table 1 below.

Table 1. Themes in Teachers' Definition of Leadership

Personal Qualities of Leaders	Knowledge and Skills for Leadership
Accountable	Has the ability to make a difference
Collaborative	Able to motivate others
Has good intentions	Organizational skills
Has vision	Can improve the school
Intrinsically motivated	Shares knowledge
Trustworthy	Has a formal role or position
Has a positive attitude	Has expertise & competence
Reflective	Decision making skills
Is a role model	Facilitation skills
Selfless	
Sensitive to others' needs	

Discussion and Implications

Leadership in Freshman Physics – part of the Physics First initiative, is an NSF funded MSP that is designed to support 9th grade physics teachers in leading curricular reform efforts in their districts.

Teacher leaders can provide the necessary scaffolds to achieve educational reform efforts for implementing Physics First. Yet, to achieve effective leadership skills and dispositions, it is crucial to first understand teachers' ideas and perceptions about teacher leadership. The purpose of this study was to gain insight into teachers' views and their self image with regard to leadership. York-Barr and Duke (2004) identified seven different dimensions of practice in which teachers carry out leadership activities. Based on this framework we created a survey (TALI) to examine teachers' self-reported experience in each of these dimensions of leadership as well as their views and participation in these activities. We also asked teachers to describe their definitions of teacher leadership. We analyzed data from 36 high school physics teachers participating in a summer academy for *Leadership in Freshman Physics* Here, we discuss our findings in light of our research questions followed by a discussion of the implications of these findings.

Our first research question asked: How do teachers define leadership within their own professional contexts? We found that teachers' definitions of leadership contained elements that fell into two major categories: *personal qualities* and the *knowledge and skills of leadership* (e.g., expertise, competence, decision-making skills, organizational and facilitation skills). The qualitative results of the study indicated that while defining leadership, most of the participating teachers give equal importance to inherent qualities of leaders and the knowledge and skills of leadership. One of these aspects has been supported by literature as well; Pellicer and Anderson (2001) also emphasized the significance of shaping teachers in terms of leadership knowledge and skills so that they can become "Instructional leaders" (p.14). While the vast majority included both elements in their definitions, however, a minority (25%) focused on either personal qualities of a leader OR knowledge and skills of a leader. The exclusive emphasis on personal qualities of a leader raises the question as to whether these teachers (either tacitly or explicitly) believe that leaders are "born" rather than viewing leadership as a skill that can be cultivated. In order to view themselves as leaders, these teachers would have to believe they possess personal qualities of a leader. Furthermore, it remains to be seen whether teachers who view leadership in terms of knowledge and skills or as a combination of personal qualities and knowledge and skills one possesses, may be more inclined to believe individuals can grow and develop as a leader than those who view leadership exclusively as personal qualities of an individual.

Related to this, our second research question asked: *In what ways do teachers perceive themselves as leaders?* and our third research question asked: *What kinds of activities do teachers consider to be leadership?* Both of these questions were addressed using the TALI. Overall, we found that although the participating teachers had leadership experiences in almost all the dimensions identified by York-Barr and Duke (2004) most of them were skeptical about their roles as leaders. Results from the TALI indicate teachers are most likely to view themselves and their peers as leaders when they are engaged in activities pertaining to participation in two particular domains of practice: preservice teacher education activities and school or district curriculum work. Though teachers are engaged in a wide range of activities, they do not necessarily consider most of these activities to be leadership. For instance, teachers report participating in contributions to profession and professional development of colleagues, but did not consider these activities to be leadership. The results of this study imply a contradictory nature to participating teachers' perception regarding leadership activities. For example, while describing their leadership experiences and defining leadership, teachers emphasized affecting their colleagues professionally, which was included as a component of teacher leadership practices by York-Barr and Duke (2004). However, teachers responded in the negative in terms of viewing professional development of colleagues as a leadership activity on the TALI. Similarly, teachers' responses to the TALI revealed that roughly half (45%) view preservice teacher education as a leadership activity, and also participated in it. On the other hand, in reporting their prior leadership experience, no single teacher mentioned any activities related to preservice teacher education.

There exists an interesting dichotomy between the activities that teachers engage in and those that they perceive as constituting leadership. In other words, most teachers do not view themselves as leaders, although they may in fact be engaging in activities that as per York-Barr and Duke's dimensions of practice <u>do</u> constitute important practices of teacher leaders. Our findings draw attention to teachers' lack of clarity in defining teacher leadership. Is it perhaps this unclear notion of leadership that makes them conclude that they are not leaders? Our findings underscore the importance of professional development programs such as *Leadership in Freshman Physics* in facilitating the formation of a common vision for teacher leadership, as well as the development of leadership skills among teachers to foster curricular reform efforts in schools and districts to better support student learning.

Myths of Teacher Leadership

Our findings reveal several myths about leadership that could potentially prevent teachers from viewing themselves as leaders. These include:

- Leadership requires a formal role or position
- Not everyone can be a leader
- Leadership takes place outside of the day-to-day activities of teaching

ALL teachers have the potential to be a teacher leader; by the virtue of their own efforts to bring about change in their own classrooms, teachers lead by example. Nonetheless, because teachers in our program often associated leadership with a formal role, they believed that not everyone is capable of serving as a leader—in other words, there might be 'too many chiefs and not enough Indians'. For example, teachers' definitions revealed they expected there to be one leader who "takes charge" and that others follow. Teachers in our program also most often associated being a leader with holding a formal position or acting in an official capacity. For example, serving as a department chair, officer in a professional organization, etc.; however, there are many informal ways in which teachers exert influence and make a positive difference in their schools. Lieberman and Miller (2004) stress that informally, teachers lead by serving as advocates, innovators, and stewards. As advocates, they speak up for what is best for student learning, framing and reframing issues so that student learning is the central focus. As innovators, they act as change agents, implementing new practices. As stewards, they positively shape the profession by contributing to their own professional growth and that of their colleagues. Finally, when asked to consider whether they viewed many of their routine activities to be forms of leadership, the majority of teachers responded 'no'—yet, these activities fell within the seven dimensions of leadership practices discussed above. In other words, teachers were already taking on leadership roles and functions in their schools, but didn't consider themselves to be leaders. They viewed leadership as being something above and beyond their day-to-day work as educators.

Teachers' perception of leadership may potentially affect their choice of pathways to accomplish their leadership goals (York-Barr & Duke, 2004). By understanding teachers' initial perceptions of leadership and the domains of practice in teachers consider to be leadership, professional developers can be better prepared to identify and address areas of growth for teacher leaders. Programs and workshops that aim to develop teacher leadership should rely on such formative assessment to inform their ongoing efforts to help teachers develop a common vision for leadership, to tackle myths teachers hold about leadership that can inhibit their development as leaders, and that can assist them in tailoring sessions to inform and cultivate teachers' leadership knowledge and skills.

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