



Science Education Teacher Leadership

Arthur Eisenkraft

University of Massachusetts Boston, United States

Abstract

An important component of distributed leadership is the decentralization of the leader [1]. In this approach, there is no one leader who is solely responsible for guiding the school. Instead, the leadership is fluid - drawing upon whoever is in the best position to offer guidance [1]. According to Harris [1], this orientation is important for three reasons: it allows multiple individuals to work collectively to guide instructional change, it allows for the work of leadership to be spread over multiple leaders, and it promotes a culture of shared responsibility over dependency. Across all of these areas, school personnel work together while building individual agency, which results in student learning.

Our theory of action is that by focusing on teachers who are willing to examine their instructional practice and take on leadership practices, they will develop into teacher leaders with high self-efficacy. In the Science Education Fellowship (SEF) program, teachers participate in professional learning experiences that deepen their understanding of teaching and learning and contribute to teachers choosing to change their practice [2]. The SEF Fellows gain leadership knowledge and skills and are then able to plan and conduct effective PD and support their fellow teachers with resources, coaching, and feedback. With approximately 12 teachers working across a district with a common purpose, distributed leadership becomes a mechanism for sustainable support.

Keywords: *teacher leadership, distributed leadership, district transformation*

Teacher leadership is well-documented to promote positive educational changes for students [3]. Understanding how to develop teacher leaders is a potentially powerful means to scale quality STEM education. The model we focus on is distributed leadership at the district-level and emphasizes (1) changes in teachers' instructional practices; (2) the development of teacher leadership; and (3) the spread of distributed leadership across the school district during and after participation in the science education leadership program. This national sample of teachers, from ~35 school districts in seven regions of the USA, helps us identify salient components of leadership within schools and districts that are transferable to other settings.

Theory of Action

Whitworth and Chiu [4] proposed a model of teacher leadership development illustrated in Figure 1 (solid arrows only) that emphasizes the critical role of district and school leaders in supporting in the planning and implementation of professional development (PD). In the SEF program, we posit that leadership must be distributed throughout a school district in order to sustain efforts that positively influence teacher practice and therefore impact the learning of students (see dashed arrows in Figure 1).

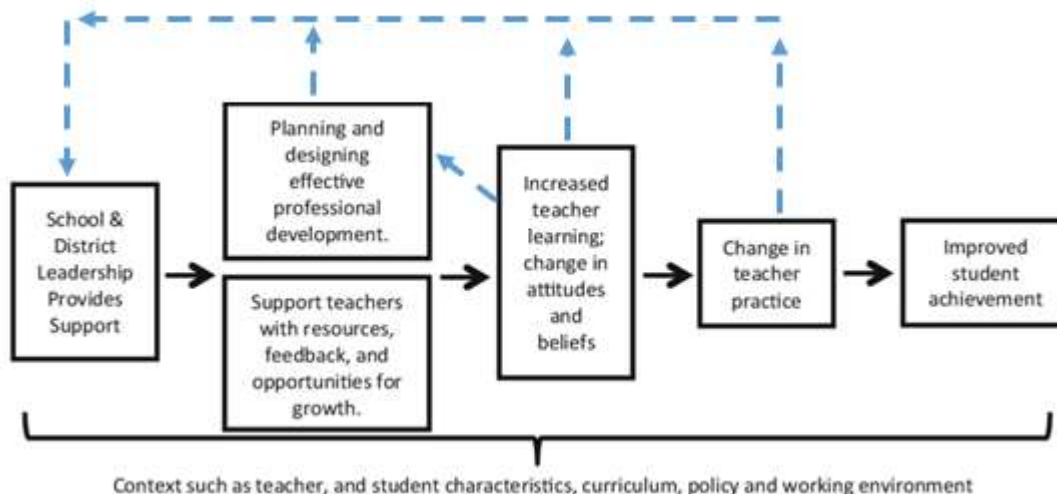




Figure 1: SEF Theory of Action – Teacher leaders can leverage their knowledge and skills and become part of district leadership to plan and lead effective PD to support their fellow teachers with resources, coaching, and feedback, thereby becoming a distributed leadership model.

The model we use adds additional pathways to this figure (the dashed arrows). During the SEF program teachers (who are called Fellows) participate in PD programming, improve their knowledge and skills, and then change their practice [2]. The Fellows also gain leadership knowledge and skills that contribute to their school and district vision and that support their fellow teachers with professional learning opportunities, coaching, and feedback. They then become the future of their schools and districts, as leadership contributors and providers.

The SEF program supports teacher learning by creating collaborative communities that support the learning of teachers and, ultimately, students. As teachers work collectively, they refine their knowledge and abilities for teaching and leadership, and expand their reach and distribute their leadership abilities. In this distributed leadership model, we view the school and the district as the units of analysis, with leadership distributed among teachers and supported by the administrators [5]. A key construct of this form of leadership is to view the social context of school as the conduit for activity that enhances both teacher and student learning [5].

Our theory of action is that by focusing on teachers who are willing to examine their instructional practice and take on leadership practices, they will develop into teacher leaders with high self-efficacy. In the SEF program, teachers participate in professional learning experiences that deepen their understanding of teaching and learning and contribute to teachers choosing to change their practice [2]. The SEF Fellows gain leadership knowledge and skills and are then able to plan and conduct effective PD and support their fellow teachers with resources, coaching, and feedback. With approximately 12 teachers (i.e. a critical mass of teacher leaders) working across a district with a common purpose, distributed leadership becomes a mechanism for sustainable support.

Context: National Implementation of the Science Education Fellowship (SEF) Program

The SEF program is a two-year fellowship involving 60 teachers from each of seven sites, chosen from participating districts resulting in roughly 420 teachers, total. Districts apply to participate in the program through the sponsoring university. High need districts are specifically encouraged to apply. Fellows apply within the selected districts and are selected based on their background, grade level, science content area, and essay responses. Fellow qualities such as being under-represented, committed to student learning, and potential to be a leader are important.

The Wipro Science Education Fellowship (SEF) program (Wipro, Ltd is the corporate sponsor) is a school district transformation program which supports teacher leaders and builds a stronger distributed leadership structure within schools. The Wipro SEF program is based upon the success of the Boston Science Partnership's Science Education Fellowship, which was supported through the National Science Foundation Math Science Partnership Program from 2009 to 2012. The intention of the Wipro SEF Program is to recruit committed teachers of science who are poised and ready to learn, to collaborate, and to be reflective on their classroom practice. The Wipro SEF program is designed to foster teaching and leadership skills in those who have a minimum of three years of teaching experience and are committed to staying in the classroom within their school district for at least the next two years. Fellows do not need to have prior leadership experience and while many teachers may find leadership skills to be helpful to pursue other career avenues in the district, this program is not designed to facilitate the transition of a classroom teacher to becoming a school-based or district-based leader. Twenty teachers from grades K-12 in the areas of biology, chemistry, physics, and earth/environmental science are selected each year from the five partner school districts at each University site. The program uses a model of teacher support and development to increase the quality of teaching and leadership in science throughout five districts in each region (MA, NJ, NY, TX, FL, MO, and CA). This model includes a comprehensive set of activities designed to improve teacher practice and effectiveness in the instruction of science.



The goals of the Program are:

1. To create and support a corps of over 400 science teacher leaders across the participating regions;
2. To institute a culture of active and reflective instruction within these teachers through the use of video and Collaborative Coaching and Learning Science communities;
3. To improve teacher quality and effectiveness through targeted professional development and improved relationships with partner districts in order to increase student achievement in science.

Three Pillars of Wipro SEF

The goals of the program are met by focusing the Fellows' professional development in three specific areas or the "Pillars" of Wipro SEF:

Reflective Practice

Fellows meet monthly as a cohort of twenty fellows for professional development workshops addressing a variety of aspects of science teaching, such as effective instructional models, pedagogical content knowledge, or how to engage students in science and engineering practices.

Leadership to Peers

In year 1, Fellows begin developing leadership skills as they work collaboratively with colleagues in larger workshops and in smaller CCLS groups as they share their classroom and provide feedback to their peers through the CCLS protocols. Providing honest and thoughtful feedback is a quality of a good leader. In year 2, Fellows identify opportunities for themselves to take a leadership role within their district and to support district initiatives.

Adult Learning

Teachers have areas of their professional lives that they hope to grow to meet a need they see in themselves or their students. To encourage their own learning, each fellow identifies and pursues opportunities for growth and learning based on his/her professional growth plans.

In year 1 of the program, the selected Fellows participate in 125 hours of professional development where teachers improve their instruction through professional learning communities [6,7], tuning protocols [8,9], and lesson study [10]. This results in a program in which these potential leaders inquire into their own teaching (guided by research-based methods and the Framework/NGSS), while working collaboratively with their colleagues. This year of professional learning moves teachers through the first two boxes in the Theory of Action in Figure 1.

In the first semester, teams are comprised of mixed grade-level K-12 teachers, "vertical teams." Each team chooses a course of study including a "Disciplinary Core Idea (DCI) and a research article regarding teaching practice. In the second semester, the teachers form "horizontal teams" across similar grade bands. Their course of study includes one "Science and Engineering Practice" (SEP) and a research article. These courses of study become the lens through which the Fellows analyze the lessons. Throughout the year, Fellows work in collaborative coaching and learning in science (CCLS) teams where they provide feedback on videos of each other's lessons, the lesson plans, and student artifacts [11].

In year 2 of the program, the teachers engage in an additional 125 hours of professional learning. A signature experience of this year is the creation and enactment of a professional development plan including a leadership project and referred to as a Growth Plan System (GPS). The GPS has two components: 1) 50 hours of support for district initiatives; and 2) 50 additional hours for a personal professional learning plan focused on improving practice. The district-aligned goal is chosen in consultation with the district science coordinator.

Project evaluation and research results

We have used a mixed methods, cross-site approach to gather both qualitative and quantitative data to assess the effectiveness of the SEF program in achieving its stated goals, which include changes in teacher practice, use of research to guide and evaluate lessons, and developing a cadre of teacher



leaders in each partnering district. Each year, we have tracked the Fellows involved in the program to assess the impact on their professional growth and have also gathered data from program administrators and district administrators to gauge the fidelity of the program's implementation across the sites and also the program's effect on the universities, districts and schools involved.

There has been broad agreement among the involved key stakeholders (e.g., Fellows, District Coordinators, higher education faculty and staff) that the SEF has been successfully implemented in each of the seven regions. The data from this evaluation study indicate that the program has been positively received by participants and has resulted in numerous outcomes and impacts for Fellows, District Coordinators and their associated schools and districts. Findings from the evaluation study have indicated that:

- There is continued evidence that Fellows involved in the SEF improve their instructional practices, science content knowledge, reflective practice and use of research in teaching practices. Many Fellows report that the program is a transformational experience for them professionally.
- Fellows have increased confidence in leadership practices such as giving/receiving feedback, informally supporting fellow teachers, presentation skills, and leading professional learning experiences in their schools/districts.
- One of the hallmark features of the program is the creation of a network of professionals who support each other, share knowledge, improve instruction, and ultimately effect change in their schools and districts. Participants value their engagement with this network and want to see it continue over time.

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