How might we empower STEM teachers with leadership and autonomy?

MANY SCHOOLS LACK OPPORTUNITIES FOR TEACHER LEADERSHIP.

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01
CONTEXT AND TRENDS

The complexities of the 21st century require a citizenry with the skills to think critically and conceptually about difficult problems and viable solutions to those problems. Science, technology, engineering, and mathematics (STEM) education is viewed as a catalyst that enables students to learn those skills and become the next generation of "innovators, educators, researchers, and leaders" (U.S. Department of Education, n.d.). However, too few students have access to high-quality STEM content and coursework along their K–12 pathways (Flores, 2011).

"To ensure high-quality STEM teaching and learning across a school or district, STEM teacher leaders must take on responsibilities beyond the four walls of their classroom, helping to drive decisions about topics such as professional development, curriculum, and instructional resources."

Among factors that affect the extent to which all students have access to a strong STEM education, the capacity of teachers to effectively engage students in meaningful STEM learning experiences is a big one. But in many cases, STEM teachers are not prepared or supported to deliver strong STEM learning opportunities to their students. To address this need, scholars contend that there is a dire need for STEM teacher leaders—teachers who are empowered with the knowledge, skills, tools, and flexibility to break free of the traditional modes of STEM teaching and learning to experiment and innovate in their classrooms (Daugherty, Carter & Swagerty, 2016; Gillespie, 2014). To ensure high-quality STEM teaching and learning across a school or district, STEM teacher leaders must take on responsibilities beyond the four walls of their classroom, helping to drive decisions about topics such as professional development, curriculum, and instructional resources.

Despite the importance for teachers to become STEM instructional leaders within their classrooms and schools, pathways for STEM teacher leadership are minimal. This situation is perpetuated by the lack of a clear understanding of "what teacher leadership looks like, how teachers develop into leaders, and the effects of teacher leadership" (Gillespie, 2014, p. 1). Even when teacher leadership development programs are established, professional development (PD) for teacher leaders is insufficient or the school environment limits teacher leaders' abilities to effectively carry out the roles in which they have been trained (Duncan & Connally, 2016).

02

DISCUSSION

How teacher leadership has been defined over the years represents a lack of clarity with regard to teacher roles (Jackson, Burrus, Bassett, & Roberts, 2010; Johnson & Donaldson, 2007) and responsibilities as leaders (Valdez, Broin, & Carroll, 2015). Teacher leadership development and pathways have thus been impeded. The traditional organizational structure of schools is hierarchical (Olson & Labov, 2014), and the development of teacher leadership challenges the long-standing perception of principals as the key drivers in educational improvement (Lambert, 2002). As a result, "the old model of formal, one-person leadership leaves the substantial talents of teachers largely untapped" (Lambert, 2002, p. 37). Top-down management structures provide little room for teacher autonomy and minimal inclination from teachers to take on leadership roles (Harris, 2005). In other words, the school leader plays a critical role both the culture and the pathways for teachers to act as teacher leaders and assume additional responsibilities.

Even in cases where teacher leadership initiatives have been implemented, these initiatives fall flat as the traditional school culture often remains in place, thereby minimizing identified teacher leaders' legitimacy and role. For example, in their study of 20 teachers who took on roles as leaders, Johnson and Donaldson (2007) found that the school culture remained hierarchical, and certain practices were reinforced that "discouraged teacher leadership," including teachers protecting their classroom autonomy, hesitancy among teachers to welcome and receive teacher-leader feedback, favoritism among school leadership in teacher-leader selection, reinforcement of teacher seniority as the main criteria for selecting teacher leaders, and ill-defined leadership roles that challenged the legitimacy of the teacher-leadership role (p. 8).

> "Specifically, teacher leadership will result from PD that focuses on strategies for building collaboration and trust among colleagues and efficient management styles."

More robust models of teacher leadership PD can help move the field forward in developing and sustaining in-school teacher leaders, and is likely fundamental to improving pedagogical practices and student educational outcomes (Borko, 2004; Yoon, Duncan, Lee, Scarloss, & Shapley, 2007), especially in STEM education. To accomplish this, principals must craft a schoolwide vision where teacher leadership PD is welcomed (Lambert, 2002). Specifically,

teacher leadership will result from PD that focuses on strategies for building collaboration and trust among colleagues and efficient management styles (Rhodes & Beneicke, 2002), creating a school culture that is welcoming of feedback in the workplace (Ingvarson, Meiers, & Beavis, 2005), being an effective teacher mentor (Moir & Bloom, 2003), deepening teacher content knowledge (Darling-Hammond & Richardson, 2009), developing teacher self-efficacy, and establishing a school culture that trusts and facilitates teachers' abilities to serve as instructional leaders in their own classrooms and to their peers.

03 BRIGHT SPOTS

To combat the abovementioned challenges, strategies to increase STEM teacher leadership opportunities must be purposeful and tailored to meet the educational needs of the school context. For starters, the U.S. Department of Education has developed a definition of STEM teacher leadership that shapes the way we envision teachers contributing to school improvement in STEM education beyond their own classrooms. STEM teacher leadership roles include but are not limited to coaching fellow teachers and modeling effective STEM instructional practices, serving as peer observers/evaluators, and designing and delivering STEM PD (U.S. Department of Education, n.d.).

In addition to defining STEM leadership, work also is being conducted at the district level to implement STEM teacher leadership opportunities in ways that empower rather than restrict teacher leaders' abilities to carry out their roles. The PD programs described below challenge the notion of a top-down hierarchical approach of school leadership. Teacher leadership is embraced, and the role of the teacher as a contributor to the overall school improvement process is welcomed. Stakeholders at the school and district levels trust teacher leaders and thus rely on teacher leaders for professional workshop trainings, as well as policy and program implementation that shapes teachers' STEM PD, builds the capacity of and empowers all teachers in a school to integrate STEM learning experiences into their classrooms, and ultimately improves student learning.

The Center for Teaching Quality (CTQ), for example, is a nonprofit organization that helps districts think through teacher leadership roles. Their concept of a "teacherpreneur" allows expert teachers to engage in coaching that will enable them to fulfill leadership roles beyond their classroom with their district sponsor support. Teachers become part of the leadership culture by utilizing a hybrid approach that allows them to lead while also maintaining teaching responsibilities. Teacherpreneurs have taken on roles such as piloting teaching labs, codesigning leadership positions, and building virtual community organizers for teachers.

Similarly, the STEAMAZing Teacher Leader Program is an eight-month program where teachers engage in skill-set and content training centered on STEM education improvement. At the conclusion of the program, participants facilitate workshops, communities of practices, and instructional improvements based on what they have learned in the program. Teacher leaders who complete the program are expected and well poised to engage in peer learning, and are able to support and/or inform instructional practices for current educators within and outside of their district and state.

The Museum of Science and Industry's Science Leadership Initiative engages several teacher leaders, as well as the school principal, to design an action plan for bringing to life a science vision for the school. Administrator contribution is a critical requirement of the program.

04

CONCLUSION

Teachers are recognized as critical to the school improvement process (Berry, Johnson, & Montgomery, 2005), including the implementation of a strong STEM education (National Science Board, 2007). To carry on the path of STEM teacher-leadership development, research on teacher leadership should continue to be synthesized and consolidated so that the understanding of the role and expectations of teacher leaders are easy to grasp within a distributed leadership context, and where the responsibility for student achievement is seen as a collective and collaborative effort among trusted teacher leaders and administrative leaders. This will allow districts and schools to provide purposeful PD training for teacher leaders, and to create the school environments and cultures that empower teacher leaders to develop innovative STEM learning experiences for students and support their peers in doing so as well.

ABOUT THE GRAND CHALLENGES WHITE PAPERS

In 2017, 100Kin10 released an unprecedented representation of the big, systemic challenges to preparing and supporting STEM teachers following over two years of extensive research alongside more than 1,500 STEM teachers and hundreds of other education experts. As a part of this work, 100Kin10 commissioned a series of short white papers from well-versed thinkers and practice-oriented researchers to synthesize the most relevant research around the specific challenge areas. Together, they compose a thoughtful and well-rounded examination of the systemic challenges currently facing STEM teaching.

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