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Reflections on the promise and complexity of mathematics coaching[☆]

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ABSTRACT

If students are to develop mathematical proficiency, then mathematics teaching must both change and improve. In an effort to provide site-based professional development addressing the mathematical content and pedagogical demands that teachers encounter in reality of public schooling, many school districts are turning to elementary mathematics coaches. Knowledgeable coaches can have a significant positive impact on teachers, yet this study documents substantial variance in the amount of coaching delivered and in the nature of activity that coaches undertake within schools. Coaches are frequently responsive to the needs of individual teachers. If this support is primarily marked by shared teaching or provision of instructional materials, it may not transform either instruction or teacher knowledge. Similarly if coaches assume duties that primarily address an administrator's needs, they will have less time to enhance a school's mathematics program. Coaches need to engage teachers in fundamental dialogue about mathematical content, mathematical learning, and student understanding. It may be that this dialogue and the effectiveness of a coach's work with individual teachers would benefit from a coach's concurrent work with grade-level teams. When a coach leads a grade-level team through discussion of targeted goals and approaches, the coach may facilitate individual teacher learning while building collective learning. When coupled with the support of a principal, this partnership may foster instructional change across a school.

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1. Introduction

For the past 30 years, school districts have faced constant pressure to meet ever-changing expectations for mathematics achievement. And while state content or curriculum standards, guidelines for state or district-wide standardized assessments, district criteria for instructional practices, and standards for mathematical practice are phrased as expectations, school administrators and teachers generally experience these as demands. The educational goals for school mathematics now portray an impressive vision of mathematics learning reflected not only in the increased rigor defining what students should understand and do (e.g., Kilpatrick, Swafford & Findell, 2001; National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010), but also in increased responsibilities for teachers because teachers' instruc-

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tional practices need to define and support more ambitious learning opportunities (e.g., Franke, Kazemi, & Batttey, 2007; Lampert, Beasley, Ghouseini, Kazemi, & Franke, 2010; Lampert & Granziani, 2009).

While the challenge of meeting new learning outcomes requires all teachers of mathematics to access and use strong mathematical content and pedagogical knowledge effectively, this challenge is especially great in elementary schools because elementary teachers typically are generalists who frequently are limited in terms of the knowledge that they may need to draw on when teaching mathematics (e.g., RAND Mathematics Study Panel, 2003; National Mathematics Advisory Panel, 2008). Further, while efforts to improve teaching and learning are typically dependent on advancing the capacity of individual teachers, approaches advancing instructional reform in mathematics must address the entire school mathematics staff. This is because even though teacher knowledge and the quality of delivered instruction critically influence student achievement (Campbell et al., 2014; Rivkin, Hanushek, & Kain, 2005), the potential for students' mathematics achievement in any one year is affected by mathematics learning and teaching in prior years. This raises an additional pressure in elementary schools because 70% of the elementary teachers participating in a recent national survey reported attending less than 16 hrs of professional development in mathematics per year over the last 3 years (Banilower et al., 2013).

In response to these challenges, school districts across the nation are turning to elementary mathematics coaches as a route to instructional change and improved student achievement (Darling-Hammond, Wei, Andree, Richardson, & Orphanos, 2009). The intent is for a knowledgeable colleague who has both instructional expertise and a deep understanding of mathematics and students to serve as the available, on-site resource for teachers. The mathematics coach is to address the mathematical content and pedagogical knowledge of teachers in the context of their practice with the intent of provoking and supporting instructional change through authentic professional development that meets individual teachers' needs (Webster-Wright, 2009). The positioning of coaches implies a policy decision that schools need to become places where not only students but also teachers can learn (Hawley & Valli, 1999).

At the same time, some models of coaching hold that the coach is also to increase a school's instructional capacity (Neufeld & Roper, 2003; Virginia Mathematics and Science Coalition, 2012). That is, the mathematics coach is expected to catalyze and sustain efforts spanning mathematics curriculum, instruction, and assessment within the reality of public schooling, supporting the emergence of collective professional practices that advance school-wide improvement as well as student learning and achievement (Marzano, Walters, & McNulty, 2005; Saphier & West, 2009/2010; York-Barr & Duke, 2004). Ideally, this coaching model allows at least two settings wherein elementary teachers may enhance their knowledge and transform their teaching, namely by engaging in individual interactions with a coach and by participating in a grade-level team led by the coach.

A recent grant-funded, professional development and research project investigating the activity and impact of elementary mathematics coaches applied this amplified perspective with coaches' responsibilities spanning coaching teachers and enhancing their schools' mathematics program. From the winter 2010 through the fall 2011, this project sponsored tuition-free, graduate coursework designed to prepare prospective elementary mathematics coaches and then supported a data-collection effort documenting the professional activity and impact of newly positioned coaches over two academic years (2011–13). While findings addressing the effect of these elementary mathematics coaches on student performance as measured by state achievement tests are addressed elsewhere (Campbell & Griffin, 2016), this report addresses one aspect of this larger effort, namely the nature and duration of the professional activity of the coaches.

The elementary mathematics coaches in this study addressed tasks advancing school-wide instructional capacity for mathematics teaching and learning as well as coaching individual teachers. Nevertheless, review of the activity patterns of these coaches permits a gross appraisal of the amount of coaching delivered and the nature of activity that coaches undertake within schools when they are positioned to advance teacher knowledge, to facilitate instructional change, and to impact a school's mathematics program. As such, the research question addressed in this report is: What activities do elementary mathematics coaches engage in and what proportion of their time do they spend completing differing activities?

2. Conceptual framework

Coaches work to advance teachers' learning within what Desimone (2009) termed the "core conceptual framework" of professional development (p. 183). As framed in terms of mathematics coaches, the core features of this framework are:

- Content focus, addressing both mathematics content and pedagogy as well as consideration of how students learn mathematics;
- Active learning, whereby a coach and teachers engage in independent or shared teaching demonstrations, co-planning, co-teaching, observation of instruction, and debriefing, as well as assessment design and data-driven decision making;
- Coherence through teacher(s)-coach discussion that addresses teachers' beliefs and prior perspectives of mathematics content, teaching, and learning in light of new learning expectations, supporting teachers' efforts to understand and reconcile state, district, and local school policy demands;
- Duration, through a coach's consistent efforts to provoke and sustain attention to problems of practice in mathematics instruction; and

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