

Situating System-level Professional Development in District Context
Monica B. Mitchell
MERAssociates

A body of literature is emerging that considers the role of the district context, including policy, governance, and general characteristics, in understanding the complexities of improving K-12 mathematics education (Cobb, 2008; Ogawa, Sandholtz, Martinez-Flores & Scribner, 2003; Spillane, 2000; Spillane, 2004). Recent research related to scaling mathematics education reform interventions as well as adoption and implementation of curricular materials elucidates the influence of the district context on instructional practice (Cobb, McClain, de Silva Lamburg & Dean, 2003; Cobb & Smith, 2008; McClain, Zhao, Visnovska & Bowen, 2009; Stein & Kim, 2009).

The standards-based reform movement in the 1990s and 2000s saw significant district involvement. These systemic initiatives focused on a theory of action based on system-wide alignment of content standards (NCTM and state), professional development, instructional materials, instructional practice, and assessment to affect improvements in student learning and achievement. Similarly in the wake of No Child Left Behind, alignment likewise is foreground as part of the legislation to advance reform primarily through accountability (Porter, 2009). Within the high-stakes testing environment, school districts have exercised increasing authority for instructional policy to influence classroom instruction (Elmore & Fuhrman, 2001; Spillane, 2004) and local implementation agents at the district level use a variety of policy-making tools to influence policy implementation that has a direct bearing on classrooms. As part of a larger research study on teachers' use of standards-based instructional materials (King, et al., 2011), the use of pacing guides for middle school mathematics was found to be widespread in urban school districts¹ and in many cases its use represented the central policy instrument for implementation of instructional materials mandates. Specifically, the pacing guide attempts to align materials and practice with standards, including appropriate and adequate content coverage, and provides focus for organizing professional development. Should the implementation pattern of the standards-based movement hold true for the Common Core State Standards (CCSS), alignment will continue to play an explicit and prominent role.

Yet a well-aligned system although necessary may not be sufficient to support standards implementation. In the case of the pacing guide study, the participating district represented a well-aligned system as well as a mature implementation site.² Despite extensive professional development tied closely to standards-based instructional materials as a consequence of the district's NSF-funded Local Systemic Change initiative, the district pacing guide deviated significantly from the materials and represented a major point of departure from curricular fidelity (Mitchell & King, 2010). The intended curriculum as embodied in the

¹ Sixteen urban school districts were surveyed to gauge the prevalence of mathematics pacing guides in the urban setting. All but one (94%) of the districts we surveyed reported using mathematics pacing guides. The districts represent some of the largest urban school districts in the country having combined student enrollment approximating 50% of all students in urban public schools in the United States.

² Based on the Survey of Enacted Curriculum indices used in the study the district's middle school mathematics program in terms of instructional materials, state standards, and state assessment exceeded the national benchmark indicator of .24 for 'good' alignment.

district pacing guide can compliment or interfere with the goals and objectives of standards-based reform and often send mixed messages associated with standards.

The needs of districts to support implementation that directly influence classroom practice extend beyond the sole issue of alignment. The decision-making surrounding the pacing guide reflected multiple factors and often conflicting tensions. As expected, external alignment with the state standards was intentional and explicit. However, the need to satisfy internal alignment with the district vision of mathematics required at the middle school level, in this case commitment to statistics and probability as a key strand, mitigated the extent of external alignment. The district's perception of students' mathematical histories and background related to limitations in computational proficiency and algebra readiness contributed to a redistribution of content strands across grades. As a result, number sense was expanded at the 7th grade and algebra diminished qualitatively at both the 7th and 8th grades, ultimately resulting in the elimination of 40% of the 8th grade curriculum. Finally, organizational issues of time constraints and staffing contributed to reordering units within grade, assigning units to another grade, and elimination of units entirely from the curriculum.

Surprisingly, attention to the integrity of the mathematics to support its cumulative progression and the integration of key fundamental concepts associated with specific topics did not figure prominently in the decision-making process. In some cases, modifications did not affect the integrity of the mathematics. While in others, the coherence of the mathematics suffered. For example, to accommodate time constraints, the district removed variability in the pacing guide as a fundamental concept to develop conceptual understanding of central tendency. In another instance, the district reordered the unit on distance two units behind the unit on symmetry and transformations instead of preceding it as a prerequisite as originally designated in the design of the materials.

Districts need guidance and support to effectively balance and address competing tensions and realities inherent in implementation. As professional development is designed and implemented, the multiple decision-making factors influencing district instructional policy must be considered. Effective professional development should be responsive to district needs and context and informed by these realities. To what extent does professional development support and facilitate negotiation of the district's vision of mathematics? How will professional development address issues of student proficiency in skill development and algebra readiness particularly at the middle school level in urban settings?

Importantly, although alignment and other issues are considerations for district decision-making, these issues cannot take precedence over explicit attention to mathematical coherence. The coherence and integrity of mathematics must be emphasized in professional development as a priority not as an afterthought. The progressive development and cumulative nature of key content areas must be well understood so as adaptations and modifications occur, and they will, at the district and classroom level, the integrity and coherence of the mathematics will be preserved. More guidance and support in this area is crucially needed. Involvement of mathematics content expertise (e.g., mathematicians) would be appropriate for this role. The content focus need also must be balanced with the pressures of alignment as well as competing tensions and issues confronting districts as they develop and implement instructional policy around the Common Core Standards.

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