



Mathematics Reform

POLICY BRIEF

Strategic Alignment of Professional Development for High Quality Mathematics Instruction

Content Into Classrooms

This policy brief was developed by Public Works and the Mathematics Coaching Consortium

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TEACHING MATHEMATICS

Public education has undergone a series of sweeping reforms in the last decade that have increased expectations and accountability for schools, teachers, and students. Demographic trends indicate higher numbers of minority students, second language learners, and increasing levels of poverty among students served in public education.

At the same time, a well-documented shortage of qualified mathematics teachers, especially in high-minority, high-poverty schools, is particularly acute at the upper elementary and middle school grades.¹ The need for high quality professional development for existing teachers centered on the mathematics content of state and national standards, a better understanding of how students learn, and bringing that knowledge to classroom instruction is clear.

PROFESSIONAL DEVELOPMENT IN THE CONTEXT OF HIGH STAKES ACCOUNTABILITY

In most districts, the delivery of professional development occurs within the context of a fragmented system of governance in which schools and districts are meeting multiple demands for accountability from state and federal initiatives. Many charge that this emphasis on compliance has resulted in a narrowing of the curriculum and a push toward instruction that relies on textbooks and high stakes assessments as the only measures of success.

This narrow and fragmented approach has continued at the same time as research has become available that reveals more clearly how students learn mathematics. Various studies have indicated that American students lag behind their international counterparts in developed nations largely because of what prevails in American mathematics classrooms—instruction that relies first on memorization and algorithms and the tendency to “jump” quickly to the “shortcut” and correct answer, without allowing time to work in depth on challenging problems. This practice contrasts to the growing body of evidence that supports an approach that encourages deeper conceptual understanding and problem solving *combined* with computational fluency and factual knowledge.²

WHAT WORKS IN MATHEMATICS PROFESSIONAL DEVELOPMENT

Solid evidence of the link between content-focused professional development for teachers and improved student outcomes has begun to transform high quality professional development to center on the importance of the teacher as well as the classroom context, often delivered through university mathematicians and others with content expertise.

More recently, another aspect of professional development has gained prominence—professional development that encourages individual and collective responsibility for student outcomes in order to achieve long-term success.

Strategic alignment of professional development at the district and school level—including supporting classroom practice, alignment of school improvement goals, and school level collaboration—are especially important. These reforms are best facilitated when districts lead the coordination of professional development efforts aligned with their policy priorities, supported by outside partners.³

- 1 California Council on Science and Technology, Newsletter, CCST Report, Volume 12, Issue 1 (February 2007). See also Critical Path Analysis of California’s Science and Mathematics Preparation System (March 2007), prepared by the California Council on Science and Technology and the Center for the Future of Teaching and Learning and Core Problems, Out-of-Field Teaching Persists in Key Academic Courses and High-Poverty Schools, Richard M. Ingersoll, University of Pennsylvania for The Education Trust (2008).
- 2 The Teaching Gap, James Stigler and James Hiebert, Free Press, New York, NY (2000); National Mathematics Advisory Panel, Final Report (2008); The Misplaced Math Student: Lost in Eighth-Grade Algebra, Brookings Institution (2008).
- 3 Professional Learning in the Learning Profession: A Status Report on Teacher Development in the United States and Abroad, R.C. Wei, L. Darling-Hammond, A. Andree, N. Richardson, and S. Orphanos, National Staff Development Council, Dallas, TX (2009); Improving Impact Studies of Teachers’ Professional Development: Toward Better Conceptualizations and Measures, Educational Researcher 38(3), L.M. Desimone (2009).

STRATEGIC ALIGNMENT IN A MODEL FOR PROFESSIONAL DEVELOPMENT IN CALIFORNIA

The Mathematics Coaching Consortium model for professional development has been developed and expanded substantially under the California Mathematics and Science Partnership Program (CaMSP), which began in 2004.

Based on evidence of success and the extension of the model to over 27 districts, the California Department of Education recently awarded a grant to create a California Mathematics Demonstration Center so that the developers of the model can expand it further and provide technical assistance to other partnerships in the state. This policy brief provides information about how the model exemplifies best practices in professional development and the evidence of success from evaluations conducted by Public Works, which has served as both state and local evaluator as the model has supported new partnerships.

A FOUR-PRONGED APPROACH TO MATHEMATICS PROFESSIONAL DEVELOPMENT

The professional development model described in this brief incorporates four components including:

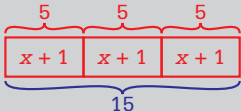
- Strengthening teacher **content** knowledge and pedagogy;
- Promoting collaborative **lesson design** based on content-focused best practices;
- Providing and coordinating full time **coaching** support in the classroom;
- Utilizing formative local benchmark **assessment** results to create instructional mitigations that transform instruction and increases student achievement.

CURRENT PARTNERSHIPS

This model for professional development is in place in multiple currently funded CaMSP partnerships that encompass 14 school districts; has been adopted as a district-wide strategy in the West Contra Costa Unified School District, which is also hosting the Mathematics Coaching Consortium; formerly funded CaMSP districts; and includes additional partners such as the Education for Change Public Charter Schools in Oakland, CA.

BEST PRACTICE #1: A FOCUS ON MATHEMATICS CONTENT

Side-by-side Comparison of Multiple Approaches

Visual (Bar Model)	Inverse Operations
	$3(x + 1) = 15$ $\frac{3(x + 1)}{3} = \frac{15}{3}$ $x + 1 = 5$ $x + 1 - 1 = 5 - 1$ $x = 4$

Summer Intensive Training: Each professional development year begins with a 30-hour summer intensive that includes mathematics content, student assessment, state and district adopted textbooks and materials, and standards-based lesson planning.

Content and Pedagogy Workshops: Monthly content and pedagogy workshops organized by grade level during the school year that include content, pedagogy, articulation, and state and district-approved textbooks are provided to participating teachers.

BEST PRACTICE #2: COACHING COMPONENT

Classroom Coaching: The Mathematics Coaching Consortium, using the same four-pronged model, trains district coaches to work with individual teachers and in site-based grade level or department teams during the school year and in summer institutes. Coaches support all teachers, while focusing on each individual teacher's content and pedagogical needs. Coaching is based on a three-tiered approach that is dependent on the needs of the individual teacher—providing demonstration lessons in the teacher's classroom, in-depth planning support, and checking in frequently to provide any additional support.

Support for Coaches: Coaches also participate in professional development through the coaches' consortium and through ongoing mentoring from lead trainers and more experienced coaches in which they are shadowed and visited during coaching sessions. Supporting coaches at their point of need is a key element of the Mathematics Coaching Consortium, which currently supports over 40 coaches.

Coaching is a balancing act—by the third year, I have seen the growth in the students over the years. A lot of teachers appreciate a second pair of eyes and having someone in there. It took time to build the relationship but now the level of trust and respect is there.

—Coach



BEST PRACTICE #3: ALIGNMENT OF POLICIES AND PRACTICES WITH DISTRICT PRIORITIES

For it to work, you need a collective commitment from all levels of the district—momentum and leadership and board support is important. The gift of this is seeing it in the classroom and teachers have taken hold of it. Coaching is embedded in our district now through a parcel tax.

—Participating Superintendent

Pacing Guides and Alignment of District Materials:

Teachers, as part of their professional development, are directly involved in the development of district pacing guides and assessments. Coaches also align their work with these materials.

Effective Use of Formative Assessments and

Instructional Mitigations: All participating teachers are introduced to the concept of “Instructional Mitigations” based on an item analysis of student results, to understand and “mitigate” misunderstandings as evidenced by the distribution of the results on the item.

Students are then re-assessed informally as well as formally to see whether the instruction had the intended result.

Common Instructional Practices Understood from the Classroom to the District Office: The model incorporates the use of effective practices coaches use when providing demonstration lessons, and that teachers use in instruction. Coaches also use these practices to support and guide teachers when they visit the classroom. Site and district administrators are also trained in these practices so that there is a common understanding of “what to look for” in instruction.

EVIDENCE OF SUCCESS

As part of the CaMSP initiative, partnerships are required to participate in the statewide evaluation conducted by Public Works, which is designed to assess overall implementation and statewide results that can be attributed to the program. In addition, partnerships are required to work with a local evaluator in order to measure teacher outcomes related to improved content knowledge and student outcomes utilizing a comparison group of both teachers and students. Public Works serves as the local evaluator for several of the partnerships supported by the Mathematics Coaching Consortium. The evaluation incorporates: (1) a pre- and post-teacher content assessment, (2) pre- and post-classroom observations conducted by coaches, (3) a survey of teachers, and (4) a quasi-experimental student outcome study.

- Over time, the model has been fine-tuned and scaled up to accommodate the model in different kinds of districts and programs.
- The coaching network has flourished—both sheltering coaches from administrative and ad-hoc duties and providing the kind of support and training that they need to continue to improve.
- Web site access benefits all partners by providing work products of the model such as hyperlinked pacing guides, lessons, presentations, parent guides, and support for instruction.
- Classroom observations indicated that teachers have increasingly employed the instructional practices embedded in the professional development (see box).
- Results from the pre- and post-assessment of teacher content from the summer intensives indicated that participating teachers significantly improved on their knowledge of the content of the summer intensive.
- A comparison of both 2010 and 2011 mathematics California Standards Test outcomes for the students of participating teachers compared to the outcomes of students taught by non-participating teachers showed statistically significant results for students of treatment teachers in evaluations

Mathematics Coaching Consortium Instructional Practices

- *Teacher uses mathematical warm-ups effectively.*
- *Teacher requires students to take notes using proper mathematical syntax.*
- *Teacher uses choral response or similar forms of including all students in the lesson.*
- *Teacher provides active student engagement through appropriate teacher modeling and student use of representations linked to symbolic forms.*
- *Teacher creates a safe environment for student thinking, reasoning, and discussion, and an opportunity for students to learn without anxiety from making mistakes.*
- *Teacher provides opportunities for formative assessment during the lesson (e.g. “you tries”).*
- *Teacher provides opportunities for student mathematical reasoning by modeling thinking and requiring students to explain their mathematical thinking verbally and in writing.*



of those partnerships. These results included positive differences in overall performance and a narrowing of the achievement gap for socio-economically disadvantaged, African-American, Latino, and English Learner subgroups.

About the Mathematics Coaching Consortium

The Mathematics Coaching Consortium (MCC) supports coaches, teachers, administrators, schools, districts, and the broader community in implementing mathematics reform through improved content, lesson design, coaching and assessment.

www.wccusd.net/math

About the California Mathematics Demonstration Center

The California Mathematics Demonstration Center has been funded by the California Department of Education to provide MCC the capacity to provide support for additional partnerships in implementing best practices for mathematics reform.

About the California Mathematics and Science Partnership

The California Mathematics and Science Partnership (CaMSP) program began in 2004. CaMSP is funded by a statewide competitive grant program administered by the California Department of Education (CDE) under The Improving Teacher Quality (ITQ) component of the No Child Left Behind Act of 2001. To date, nine separate cohorts of partnerships have been authorized by CDE involving 127 partnerships, 485 districts and 13,558 teachers.

www.cde.ca.gov/pd/ca/ma/camspsintrod.asp

About Public Works

Public Works is a non-profit corporation dedicated to working with schools, government agencies and the non-profit sector by providing services and resources to organizations that educate and inform children, youth and families. Our mission is to put data into action, transforming statistics into information that informs decisions, improves accountability and communicates the impact of public policy.

Public Works has served as the statewide evaluator for the CaMSP program and for the Mathematics Coaching Consortium. The evaluation incorporates both process measures focused on how the program is implemented and outcome measures focused on the results of the program and interventions.

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