

Research-Informed Answers for Mathematics Education Leaders

Improving Student Achievement by Leading *Sustained Professional Learning* for Mathematics Content and Pedagogical Knowledge Development

Our Position

The National Council of Supervisors of Mathematics believes that intensive and sustained high-quality professional development for all teachers and leaders of mathematics is essential to improve student achievement. In order to promote and support changes in classroom practice that ensure all students have access to the best mathematics instruction available, teachers and leaders in mathematics need a strong school and district support system for intensive and sustained professional learning. The professional learning should be content-specific and research-based. Key elements of intensive and sustained high-quality, content-based professional learning must:

- reflect a well-defined vision of quality mathematics and effective classroom practices.
- provide opportunities for teachers to enhance their mathematical knowledge and skills.
- improve teachers' classroom practice and lesson planning.
- be situated in the context of the teachers' work environment.
- provide time and resources for teachers to work in collaborative teams.
- be sustained and focused on student learning.

- promote high-quality, content-based teaching and address equitable outcomes for all students.
- allow time for mathematics teachers to practice and reflect on various methods for teaching and representing mathematics content.

Research that Supports our Position

The professional development that is provided to teachers of mathematics, at all levels of the education system, needs to be both effective and efficient. By design, high-quality professional development in mathematics should increase the mathematical knowledge and skills of the teachers. Improved teacher classroom practice and planning will lead to improved student performance and understanding of mathematics.

Loucks-Horsley, Hewson, Love and Stiles (1998) created a research-based professional learning design framework for teachers of both science and mathematics. Research supporting elements for this design framework included Banilower, Boyd, Pasley & Weiss, 2006; Shimkus & Banilower 2004a; Heck & Crawford 2004b; and Loucks-Horsley, Stiles & Hewson 1996. This design was expanded (Loucks-Horsley, Love, Stiles, Mundry, and Hewson 2003) to a more current framework that requires use of the following elements when mathematics education leaders plan for professional learning:

- professional learning leaders must possess knowledge and essential understanding about learners and learning, teachers and teaching, the nature of mathematics, the nature of professional learning, and the change process.
- the context of the professional learning is critical to sustained and teacher learning.
- critical issues to be faced such as time, equity, professional culture, leadership, sustainability, and public support should be considered for all stages of the staff learning process.
- strategies for providing professional learning should include: aligning and implementing curriculum, examining teaching and learning, immersion in mathematics content, coaching and mentoring, and collaboration with colleagues.

Professional learning for mathematics teachers should place them primarily in the role of learners, according to the Mid-Continent Research for Education and Learning (McREL p. 178, paragraph 2). Teachers most readily view professional learning as relevant when it is practice-based or job-embedded. The most effective teacher learning initiatives are conceptualized and implemented as an overall program of work, not as a laundry list of professional learning offerings (Banilower & Shimkus 2004).

Research has also studied the *effects* of various kinds of professional learning on teachers of mathematics. Garet and colleagues (2001) examined a variety of professional learning characteristics that had been identified as “best practices” and their effects on teacher knowledge and skills for changes in classroom teaching. They found significant effect on all outcomes and identified three mediating factors: Content knowledge, active learning opportunities, and coherence of professional learning with the daily work of the teachers. Furthermore, Banilower and Shimkus (2004) found that “active learning

opportunities and teacher-to-teacher interactions are attributes” of high-quality professional learning.” These attributes seem more likely to characterize sessions that “engage teachers in problem-solving/investigations” (p. 24). Goertz, Floden, and O’Day (1995) studied exemplary schools and districts, and concluded that the greatest influence on teacher capability for improved instructional practice occurs at the school or within school site level. This means that professional learning is most effective when it is embedded in the context of a teacher’s work environment.

Thus, extensive, coherent professional learning seems to be more effective than a one-shot approach. Professional learning that supports a teacher focus on using instructional materials to develop content and pedagogical knowledge within the context of teaching particular units is beneficial. Teachers who participated to the greatest extent in this type of professional development showed the greatest increase in developing and implementing “investigative classroom practices and investigative classroom culture” (Heck & Crawford 2004a, p. 21). Teachers with the most extensive participation also showed the greatest growth in their pedagogical preparedness, mathematics/science content preparedness, and use of reform-oriented teaching practices. Thus, coherence is accomplished through an individual and collective teacher focus on student outcomes.

Thus, words such as “staff development,” “staff training,” “professional development,” and “in-service” are terms that are no longer useful. It is necessary to “abandon *professional development* and make *professional learning* an everyday experience for all educators” (Fullan, 2007). **{Emphasis added.}** Teachers do not need to be *staff developed* — something that is done to them. Teachers do need to participate in ongoing professional learning — an act of continual participation and action with others in the context of their workplace.

Finally, Kennedy (1999, 1998) studied the relationship of teacher classroom practices and student performance. She synthesized research on the effects of in-service professional learning programs on student learning and found that the most important differences in student outcomes among various programs were due to the *content* of the professional learning provided, not the forms or structures of the in-service program. This supports the contention that the quality of the mathematics staff learning content provided by the mathematics leaders should be a top priority.

How NCSM Members can Implement our Position

NCSM members must act to create and sustain structures that will support a culture of meaningful and ongoing professional learning for all mathematics teachers. Moreover, this professional learning should be provided within the context of the teacher's local work environment. More specifically, NCSM members must:

- 1) Engage all mathematics teachers in a shared process for developing a clear vision of effective classroom learning and teaching of mathematics.
- 2) Create professional learning goals based upon a local analysis of student mathematics learning and achievement.
- 3) Provide intensive mathematics teachers' professional learning in order to allow time for practice, reflection, feedback, revision, and institutionalization for continuous improvement of mathematics instruction.
- 4) Design mathematics professional learning activities that model effective classroom practices and lesson planning.
- 5) Create mathematics professional learning opportunities for teachers to learn various approaches to teaching mathematics content.

- 6) Create professional learning opportunities that engage mathematics teachers as learners, strengthening learning community cultures.
- 7) Ensure that mathematics professional learning activities engage mathematics teachers in problem solving, integrating new learning, and collegial collaboration.
- 8) Ensure that professional learning requires mathematics teachers to focus on all students learning important mathematics.
- 9) Inform school and district administrators regarding the necessary policies and practices that will adequately support mathematics professional learning, linking it within the context of the educational system.
- 10) Require administrators to participate in mathematics professional learning on an ongoing basis.

One of a series of position papers of the
National Council of Supervisors of Mathematics
www.ncsmonline.org
© 2007

Reference List

- Banilower, E.R. (2000). *Local systemic change through teacher enhancement: A summary of project efforts to examine the impact of the LSC on student achievement*. Chapel Hill, N.C.: Horizon Research, Inc.
- Banilower, E.R., Boyd S.E., Pasley, J.D., & Weiss, I.R. (2006, December). *Lessons from a decade of mathematics and science reform: A capstone report for the Local Systemic Change through Teacher Enhancement Initiative*. Chapel Hill, N.C.: Horizon Research, Inc.
- Banilower, E.R., & Shimkus, E.S. (2004, June). *LSC professional development study: An analysis of data collected between 1997 and 2003*. Chapel Hill, N.C.: Horizon Research, Inc.
- Garet, M.S., Porter, A.C., Desimone, L., Birman, B.F., & Yoon, K.S. (2001). What makes professional development effective? Results from a national sample of teachers. *American Educational Research Journal* 38 (4), 915-945.
- Goertz, M.E., Floden, R.E., & O'Day, J. (1995). *Studies of education reform: Systemic reform. Volume I: Findings and conclusions*. Rutgers, N.J.: Consortium for Policy Research in Education (CPRE).
- Heck, D.J., & Crawford, R.A. (2004a, June). *LSC teacher questionnaire study: A longitudinal analysis of data collected between 1997 and 2003*. Chapel Hill, N.C.: Horizon Research, Inc.
- Heck, D.J., & Crawford, R.A. (2004b, June). *LSC teacher questionnaire study: Indicators of systemic change: A longitudinal analysis of data collected between 1997 and 2003*. Chapel Hill, N.C.: Horizon Research, Inc.
- Kennedy, M. (1998, December). *Form and substance in inservice teacher education*. (Research Monograph No. 13). Madison, WI.: National Institute for Science Education.
- Kennedy, M. (1999, November). Form and substance in mathematics and science professional development. *NISE Brief*, 3 (2).
- Loucks-Horsley, S., Hewson, P.W., Love, N., & Stiles, K.E. (1998). *Designing professional development for teachers of science and mathematics education*. Thousand Oaks, CA.: Corwin.
- Loucks-Horsley, S., Love, N., Stiles, K.E., Mundry, S., & Hewson, P.W. (2003). *Designing professional development for teachers of science and mathematics education* (2nd ed.). Thousand Oaks, CA.: Corwin.
- Loucks-Horsley, S., Stiles, S., & Hewson, P. (1996, May). Principles of effective professional development for mathematics and science education: A synthesis of standards. *NISE Brief*, 1 (1).
- Mid-continent Research for Education and Learning (McREL). (2001, October 31). *Standards in classroom practice: Research synthesis*. (Regional Educational Laboratory OERI Contract #ED-01-CO-0006, Deliverable #2001-17). Aurora, CO.: Author.
- Mundry, S., Spector, B., Stiles, K., & Loucks-Horsley, S. (1999). *Working toward a continuum of professional development experiences for teachers of science and mathematics* (Research Monograph No. 17). Madison, WI.: National Institute for Science Education.

National Council of Supervisors of Mathematics

Mission Statement

The National Council of Supervisors of Mathematics (NCSM) is a mathematics leadership organization for educational leaders that provides professional learning opportunities necessary to support and sustain improved student achievement.

Vision Statement

NCSM envisions a professional and diverse learning community of educational leaders that ensures every student in every classroom has access to effective mathematics teachers, relevant curricula, culturally responsive pedagogy, and current technology.

To achieve our NCSM vision, we will:

- N: Network and collaborate with stakeholders in education, business, and government communities to ensure the growth and development of mathematics education leaders
- C: Communicate to mathematics leaders current and relevant research, and provide up-to-date information on issues, trends, programs, policies, best practices and technology in mathematics education
- S: Support and sustain improved student achievement through the development of leadership skills and relationships among current and future mathematics leaders
- M: Motivate mathematics leaders to maintain a life-long commitment to provide equity and access for all learners

Revised July, 2007