

For more information
about findings from the study of
Local Systemic Change (LSC)

*professional development for
Mathematics and Science teachers,*

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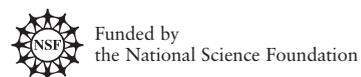
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**PROFESSIONAL
DEVELOPMENT**
for
**Mathematics and
Science Teachers:**

*Findings from a decade of
Local Systemic Change
Projects*



Funded by
the National Science Foundation

Teaching
is the highest form of
understanding.

—ARISTOTLE



LSC (Local Systemic Change)

*A legacy of system-wide improvement
in mathematics and science education*

WHO will prepare the next generation of students for the jobs of the future? Who will teach tomorrow's engineers, research scientists, financial advisers, software programmers, mathematicians, astronauts and economists? In today's education policy arena, strengthening STEM – science, technology, engineering and mathematics – is a complex and critical issue, which demands the improvement of teacher quality. In meeting the need to change the way teachers teach mathematics and science, professional development plays a vital role.

HOW can school districts provide teachers with the professional development they need? What happens when teachers participate in long-term, intensive courses and workshops along with content experts and teacher colleagues, to deepen their knowledge of mathematics and science, examine student work, and refine their teaching practices?

Research based on a ten-year evaluation of the Local Systemic Change (LSC) Initiative in mathematics and science, provides substantial evidence about improving teacher professional development throughout school systems. The initiative was funded by the National Science Foundation's Division of Elementary, Secondary, and Informal Education with the goal of providing teachers with opportunities to deepen their content and pedagogical knowledge in the context of high-quality instructional materials. The idea was that classroom teachers would be better prepared through this professional development program, provided they also received on-going support from the system, including administrators and the community at large. Longitudinal studies of the LSC initiative have now culminated in a major conclusive report, released in early 2006 by Horizon Research, Inc., Chapel Hill, North Carolina.



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About the LSC Initiative

The Local Systemic Change (LSC) initiative, funded by NSF's Division of Elementary, Secondary, and Informal Education, was designed to address the professional development of all teachers responsible for teaching science and/or mathematics within educational systems (e.g., entire grade bands, schools, or districts). The LSC was implemented in a wide variety of contexts, including districts that serve high proportions of minority and English Language Learners, and developed strategies to meet the unique needs of urban, rural, and suburban districts. LSC projects established professional communities to enable teachers to deepen their knowledge, reflect on their own teaching and learning, and change their instructional practices. Projects included teachers of science, mathematics and/or technology typically participating in professional development sessions in the summer and throughout the academic year. Teachers were given opportunities to develop and apply new knowledge and skills within a supportive school/district culture.

About the Study

Evaluation of the Local Systemic Change initiative encompassed 88 funded projects, nationwide, over a period of 10 years. Evaluators interviewed LSC project leaders, assessed the quality of professional development sessions, queried teachers and principals, observed classroom instruction, and tracked the district policy environment. Data collection included observations of more than 2,400 professional development sessions and 1,620 mathematics and science lessons, as well as 75,000 teacher questionnaires, 17,380 principal questionnaires, and 1,782 teacher interviews. As a result of the evaluation, new classroom observation protocols were developed and over 200 classroom observers were trained to use these protocols. These protocols are also used nationally outside of the LSC both to evaluate instruction and as a tool to help the education community develop a vision of effective instruction.

...In a fourth grade classroom, the teachers and students discussed angles and lines for a full 20 minutes...the learning environment created in these classrooms was one of calm, deliberate, unrestricted exploration.

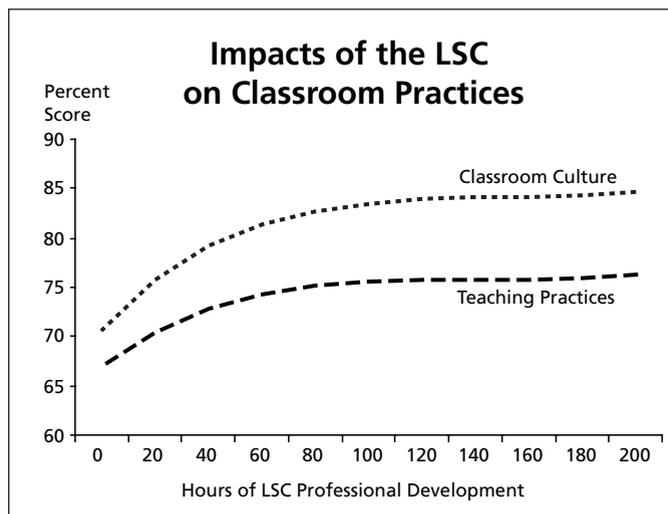
—EVALUATOR, K-12 MATHEMATICS LSC

Among the most important findings:



Impact on Teachers

Samples of targeted teachers were asked about their preparedness and their classroom practice each year. Results suggest that the LSC professional development had a positive impact on both, although there seemed to be a limited impact beyond 80 hours of professional development.



The figure shows the relationship between the extent of teacher participation in Local Systemic Change (LSC) professional development and two indicators of effective teaching practices: (1) establishing a classroom culture that supports student discussion and analysis; and (2) employing teaching practices that encourage students' active engagement in investigations. (Source: CAPSTONE Report, Horizon Research, Inc., 2005).

I look at student learning completely differently. ...The professional development experience made me realize that kids need time, developmentally, to understand the concepts.

—TEACHER, K-12 MATHEMATICS LSC

LSC professional development is also linked to a number of positive outcomes in teachers' work in the classroom, as documented in evaluators' classroom observations. Among the improvements in science and mathematics instruction were:

- 1) Greater emphasis on content and conceptual understanding
- 2) Increased engagement of students in questioning and sense-making
- 3) Increased emphasis on students communicating ideas and presenting evidence to support their claims.

The LSC districts developed unique strategies to address the diverse challenges faced by school systems across our nation in improving science and mathematics education — teacher turnover; student mobility; forging disciplinary partnerships with higher education, informal science institutions, and industry; and development of sustainable infrastructures.



Use of Instructional Materials

The LSC approach to professional development was guided by current "wisdom of practice," offering teachers an opportunity to learn mathematics and science in the context of instructional materials selected by their school district. This versatile design included exploration of materials through practice, investigation, problem solving and discussion, and allowed teachers to transfer new knowledge to their work with students in the classroom. Evaluation data indicate that sessions addressing content and pedagogy in the context of the materials resulted in higher quality classroom instruction.

...the most important thing about what [the LSC] was able to do over the years is to get science for elementary kids on the docket.

...Every year is a science year for us.

—TEACHER, K-8 SCIENCE LSC



Building a Supportive Context for Reform

Through a variety of strategies, LSCs communicated a vision of high quality mathematics/science education to parents, school board members, school administrators, faculty and staff. In most LSC projects, cadres of master teachers emerged with strong commitments to sustaining professional development in science and mathematics at the district level. Moreover, establishing partnerships with university faculty resulted in collaboration on professional development activities and development of courses for new and veteran teachers. Today, notable examples of the LSC impact can be found in districts which continue to reserve their staff development days for mathematics and science professional development tied to the curriculum. Other examples of lasting impact include management systems created by districts to distribute/replenish curriculum materials and accompanying kits needed for instruction; and the alignment of teacher evaluation with the district vision for mathematics and science teaching and learning.



Taking the Long View — LSC Capstone Report

Over the last decade, NSF's Local Systemic Change program has left its mark on teachers, classrooms, schools and districts. Horizon Research, Inc. has prepared a new Capstone report to examine the impact of the LSC, from both a cross-sectional and a longitudinal perspective. Key findings are relevant to current large-scale reform efforts; for example, professional development programs that reach large numbers of teachers in a school district, or statewide. The findings will inform project designers and education leaders who are embarking on similar reforms in mathematics and science that are intended to influence teachers on a system-wide basis.

The districts are beginning to realize that they have a treasure trove of well-trained teachers who can help them sustain the growth of the project.

—PRINCIPAL INVESTIGATOR 6-12 MATHEMATICS LSC

We think of ourselves as a coordinated system, serving the schools...and that is a whole different way that this system has aligned itself.

—DISTRICT ADMINISTRATOR, K-8 SCIENCE LSC