

**Presentation of Dr. Iris R. Weiss  
President, Horizon Research, Inc.  
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Regardless of the quality of their initial preparation, all professionals need opportunities to keep up with advances in their field. Lawyers, physicians, and other professionals have these opportunities on a regular basis. How about teachers?

Unfortunately, most teachers, especially those at the elementary level, spend very little time on professional development in mathematics and science. Although elementary teachers are expected to teach science as well as other subjects, in 2000, half of the teachers in grades K-4 had not participated in any professional development related to science or science teaching in the past 12 months. The fact that there are substantial numbers of middle and high school mathematics and science teachers teaching out of their fields of expertise makes additional focus on professional development critical at those levels as well. If we are going to expect world class performance from our students, we need to give them world class teachers, teachers who have a deep understanding of mathematics and science and are current in their fields.

I would like to share with you some of the findings of a ten-year, cross-site evaluation of the Local Systemic Change (LSC) initiative, which focused on in-depth, content-specific professional development for mathematics and science teachers. I believe that the lessons learned in this initiative have implications for large-scale reform more generally.

The key messages I want to leave you with today are these: (1) A decade of research on the Local Systemic Change experience indicates that sustained, content-specific professional development in mathematics and science can be broadly implemented, reaching a critical mass of teachers; and (2) This kind of professional development leads to improved mathematics and science instruction.

The 88 LSC projects funded by NSF reached approximately 70,000 elementary and secondary teachers and two million students in 4,000 schools in 31 states. Nearly half of the targeted schools were in urban areas, a quarter in suburban areas, and the rest about equally split between rural areas and towns or small cities. Across all schools targeted by the LSCs, just over half of the students were from minority groups.

The overall goals were similar across projects, including deepening teachers' knowledge of mathematics/science content, and helping them become more conversant with the instructional materials they were expected to use in their classrooms. However, the specific approaches varied. In one school district, you might see a several day Institute in the summer, where teachers worked with university science faculty to learn more about electricity, and try out experiments that they would later use in their classrooms. In another project, you might see teachers meeting every month with a mathematics coach, working through the concepts involved

in understanding rational numbers, the difficulties their students might experience, and how to address those problems.

As part of the LSC experience, NSF decided to support a cross-site evaluation, involving trained evaluators in collecting the same kinds of data at each site, so the results could be aggregated across projects. One of the strengths of the cross-site evaluation was the gathering of data from multiple sources, through observations of professional development sessions and mathematics/science classrooms; teacher and principal questionnaires; and interviews with project staff and participating teachers. The analyses reported in the capstone report are based on a great deal of data, including more than 1600 classroom observations and more than 75,000 teacher questionnaires.

What did we learn?

Teacher participation in LSC professional development was linked to higher ratings of the quality of mathematics and science lessons. For example, 51 percent of the observed lessons that were taught by teachers who had participated in the LSC received high ratings for the quality of teacher questioning – questioning that would help to move student understanding forward -- compared to 40 percent for the non-participants. Similarly, lessons taught by LSC participants were more likely to include appropriate “sense-making,” where teachers helped the students summarize the important ideas in the lessons.

At the elementary level, where science is generally a low priority, participating teachers devoted more time to science instruction. These kinds of impacts on classroom practice were evident with about 30 hours of professional development, typically increased until about 80 hours of professional development, and then leveled off.

The combination of professional development and use of the designated instructional materials had a greater effect than either alone. Lessons based on the designated materials and taught by teachers who had participated in LSC professional development were more than twice as likely to receive high ratings (39 percent versus 15 percent).

LSC projects had success in building stakeholder and policy support for the LSC vision and professional development activities. One of the key lessons LSC leaders learned was the importance of involving principals “early and often.” When principals were “on board,” they encouraged teachers to participate in LSC activities, made time for them to do so, and facilitated the work of teacher leaders in their schools.

LSC projects also benefited from partnerships with colleges and universities, business and industry, and science museums. These partnerships, and the cadres of teacher leaders developed in the LSCs who are continuing to share this expertise with other teachers, are among the lasting impacts of the initiative.

The LSC initiative did not meet its ambitious goal of providing all targeted teachers with 130 hours of professional development, in part because of teacher turnover. However, setting that goal motivated the school districts to recruit more than the volunteers they usually counted on to

participate, so the projects reached larger proportions of district mathematics/science teachers than did many efforts in the past.

LSCs faced a number of other challenges that tended to limit their impact and staying power. Reaching a large number of teachers required a considerable number of professional development providers, but it was sometimes difficult to find a sufficient number of well-prepared people for this task. Also, while basing professional development on student instructional materials helps teachers transfer what they are learning to their teaching, the emphasis projects placed on student instructional materials sometimes got in the way of addressing teachers' broader content needs.

What do all of these data tell us?

First, a one-shot workshop is not going to be equal to the task; rather, mathematics and science teachers need on-going, coherent professional development.

Second, focusing professional development on student instructional materials is a promising strategy for enabling teachers to improve their classroom practice, especially if there are mechanisms in place to keep the focus on disciplinary content, helping teachers understand how the tasks they are using in their classrooms are intended to contribute to student understanding.

Third, the LSC experience shows that, with a concerted effort involving stakeholders from both within and outside the districts, large-scale professional development is both possible and effective.

I would like to address one other important point. Is there reason to believe that school districts can provide on-going, content-rich professional development for all of their mathematics and science teachers without grant funding? I think the answer is yes. Especially in large urban districts, there is considerable money available for professional development. The challenge is to spend those funds in a coherent, coordinated fashion, and the LSC experience provides promising models for achieving that coherence.

Now I'd like to introduce a leader of one of the LSC projects who will talk about the evidence of impact of the LSC on teaching and learning in his district. Dr. Michael Klentschy is Superintendent of El Centro, CA schools and served as Principal Investigator of the LSC efforts in a consortium of districts in the very southernmost part of California, near the border with Mexico.

Thank you.