Chapter One
Introduction to the Local Systemic Change Initiative

In the spring and summer of 1995, the National Science Foundation (NSF) funded the first cohort of eight projects in a new initiative, the Local Systemic Change through Teacher Enhancement (LSC) program. Eighteen additional projects were funded in 1996 and 20 more in 1997, for a total of 46 projects in Cohorts 1, 2, and 3.

The goal of the LSC program is to improve the teaching of science, mathematics, and technology by focusing on the professional development of teachers within whole schools or school districts. Each targeted K–8 teacher is to participate in a minimum of 100 hours of professional development; at the secondary level, the minimum is 130 hours over the course of the project. In addition to its focus on involving all teachers in a jurisdiction, the LSC initiative is distinguished from previous teacher enhancement efforts by its emphasis on preparing teachers to implement designated exemplary mathematics and science instructional materials in their classrooms.

LSC projects are expected to align policy and practice within the targeted district(s) and to include:

- A shared comprehensive vision of science, mathematics, and technology education;
- Active partnerships and commitments among stakeholders;
- A detailed self-study that provides a realistic assessment of the current system's strengths and needs;
- Strategic planning that incorporates mechanisms for engaging each teacher in intensive professional development activities over the course of the project; and
- A set of clearly defined, measurable outcomes for teaching, and an evaluation plan that provides ongoing feedback to the project.

The LSC solicitation indicated NSF's plan to "provide a framework for data collection (including a set of instruments and procedures) that will allow the Foundation to evaluate individual projects, aggregate data and information across projects, and produce a cross-project analysis" (NSF 94-73). NSF contracted with Horizon Research, Inc. (HRI) of Chapel Hill, NC to design the data collection framework, provide technical assistance in its implementation, and prepare a cross-site analysis of the evaluation results.

This chapter provides an overview of the LSC projects and a description of core evaluation data collection activities. Subsequent chapters present the findings from the core evaluation activities conducted from September 1, 1996 through August 31, 1997.

An Overview of Cohorts 1, 2, and 3

Project data sheets completed by the PIs provide some basic information about the 46 LSC projects included in Cohorts 1, 2, and 3.[1]

- In 1996–97, the LSC initiative included 25 K–8 science projects, 5 K–8 mathematics projects, 9 secondary mathematics projects, 4 projects that targeted both elementary mathematics and science, and 3 projects that targeted both elementary and secondary mathematics.

- Nineteen of the 46 LSC projects are single-district projects; at the other end of the scale, 3 projects involve more than 20 districts.

- Thirty-four of the 46 LSC projects are five-year projects, 8 are four-year, and 4 are three-year.

- The 46 LSC projects plan to involve a total of approximately 40,000 teachers in more than 2,000 schools in 263 districts across the United States.

- By the completion of these projects, an estimated 1,356,000 students will receive instruction from LSC-treated teachers each year.

Participating Schools

As can be seen in Figure 1, slightly more than half of the schools targeted for the LSC are in urban areas; only 7 percent are in rural areas.

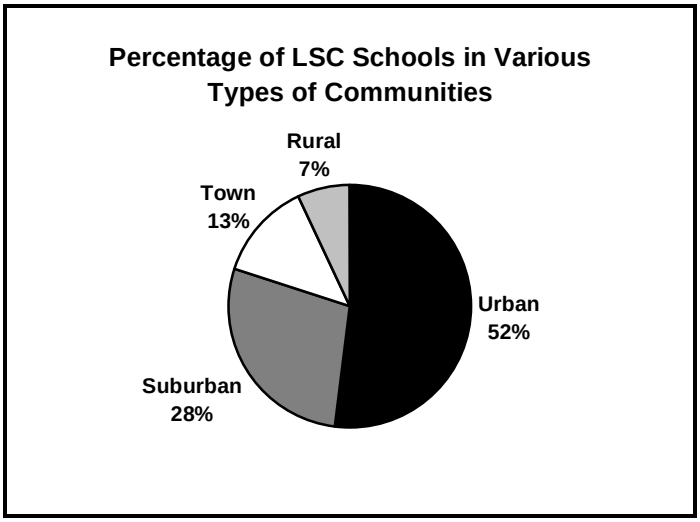

Figure 1

[1] An abstract of each of these projects is included in the "Local Systemic Change Project Directory" available from the National Science Foundation. The Directory can also be accessed through the NSF home page at www.nsf.gov/cgi-bin/getpub?nsf 97145.

In terms of student demographics, across all schools targeted by the LSCs, 51 percent of students are white, 24 percent African-American, 17 percent Hispanic, 6 percent Asian or Pacific Islander, and 2 percent American Indian or Alaskan Native. As can be seen in Figure 2, projects targeting K–8 mathematics serve the largest proportion of minority students, but in each subject the percent of minority students is far greater than the national average of approximately 30 percent.

The typical school targeted for K–8 mathematics and science reform by the LSC projects has approximately 600 students, 52 percent of whom qualify for free or reduced-price lunches and 16 percent of whom are of limited English proficiency (LEP). The typical school targeted for 7–12 mathematics reform has 1,020 students, 32 percent of whom are eligible for free or reduced price lunches and 9 percent of whom are LEP.

Race/Ethnicity of Students to be Impacted by the LSC Projects

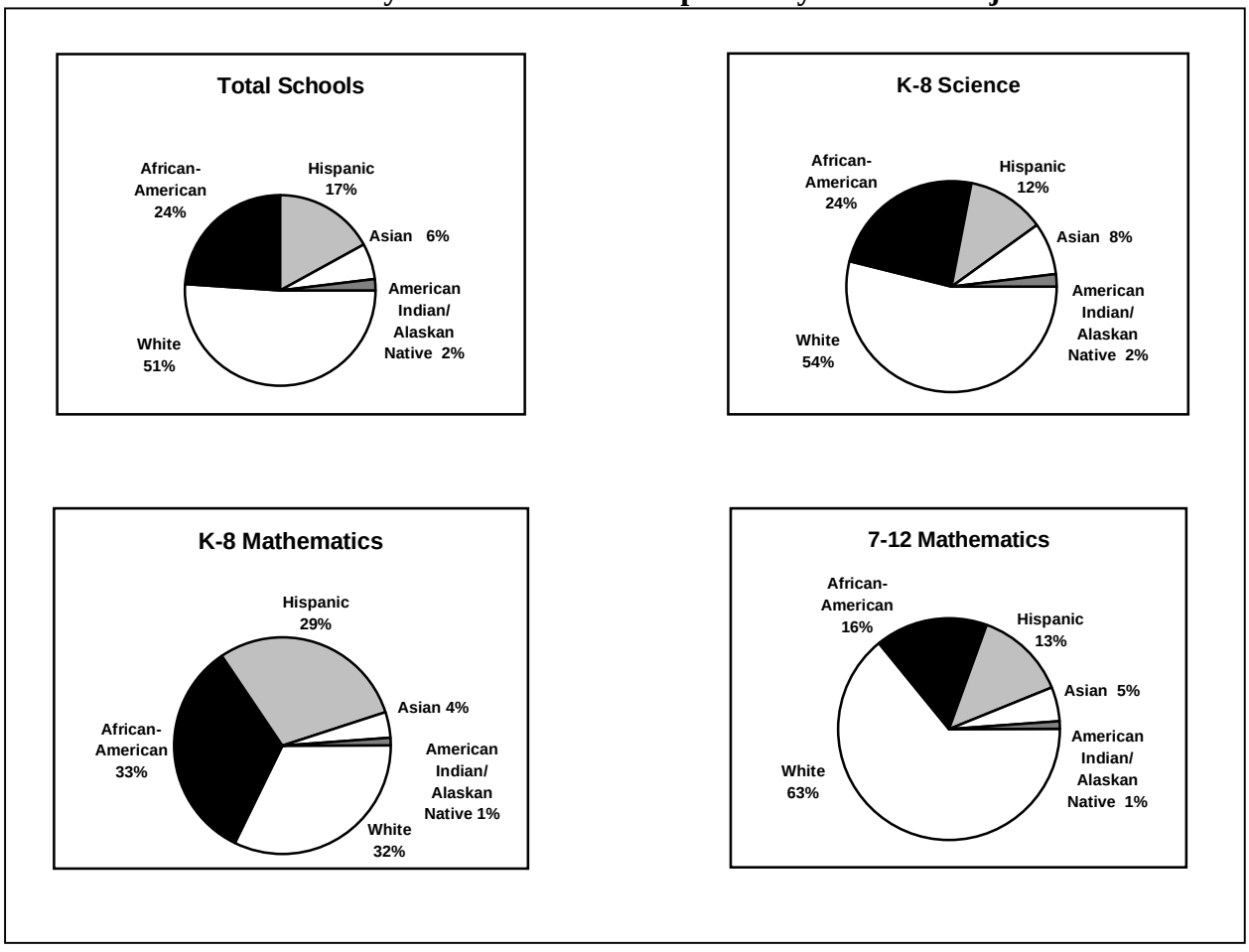

Figure 2

Characteristics of LSC Professional Development

Almost all of the LSC projects (96 percent) report that they are preparing teacher leaders to serve as mentors within the school. Substantially fewer include a peer mentoring/teaching component (74 percent) or teacher study groups (65 percent) as part of their repertoire of professional development activities.

The LSC projects are using a diverse set of professional development providers. Nearly all of the projects report that they are using lead teachers in some capacity. Many also involve scientists, mathematicians, and engineers from higher education, business/industry, and museums and other community organizations. (See Table 1.)

Table 1
Professional Development Providers in LSC Projects

	Percent of Projects
Education Professionals	**98**
Lead Teachers	96
Higher Education	74
District-Level Personnel	52
Museums/Community Organizations	33
Scientists/Mathematicians/Engineers	**80**
Higher Education	72
Business/Industry	50
Museums/Community Organizations	30

While the focus of the LSC initiative is on providing high-quality professional development services to mathematics and science classroom teachers, many of the projects are also involving others in the school, district, and larger community. Figure 3 shows the percent of projects reporting that they have a formal component aimed at each of a number of groups within the LSC schools. Note that most LSC projects have a formal component aimed at principals, and almost half of the projects involve special education teachers, while other groups are less frequently targeted.

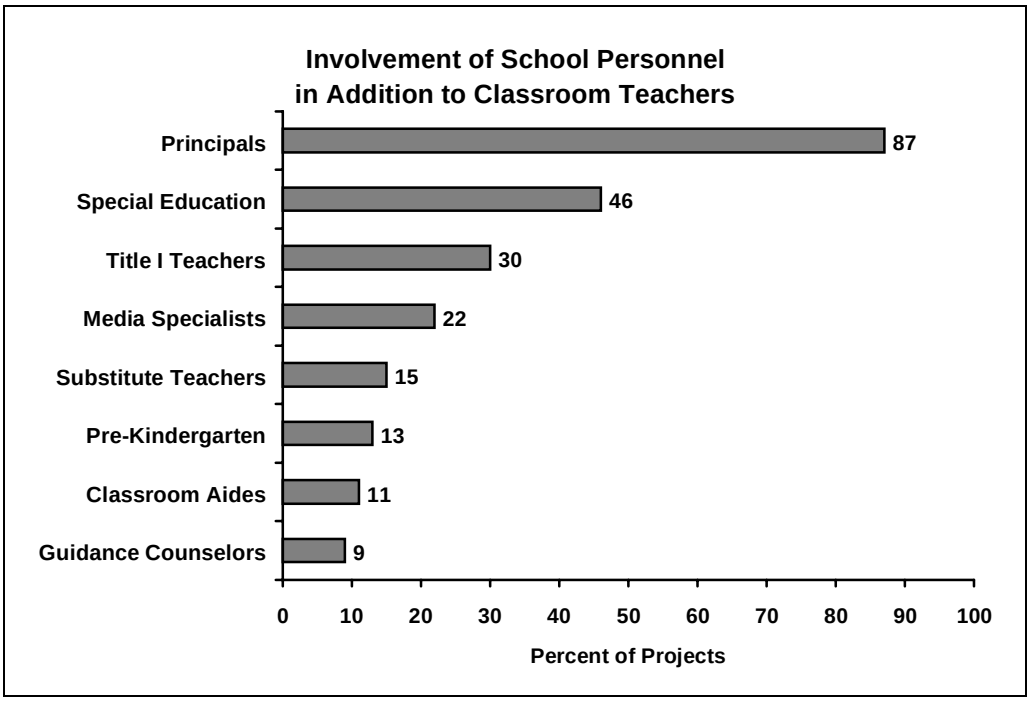

Figure 3

Figure 4 shows analogous data for groups outside the school. Slightly more than half of the projects report that they work with parents, roughly 40 percent include activities for central office staff and for business/industry representatives, and 26 percent target higher education faculty. Only 15 percent of the projects target pre-service teachers, and only 9 percent have a component aimed at the general public.

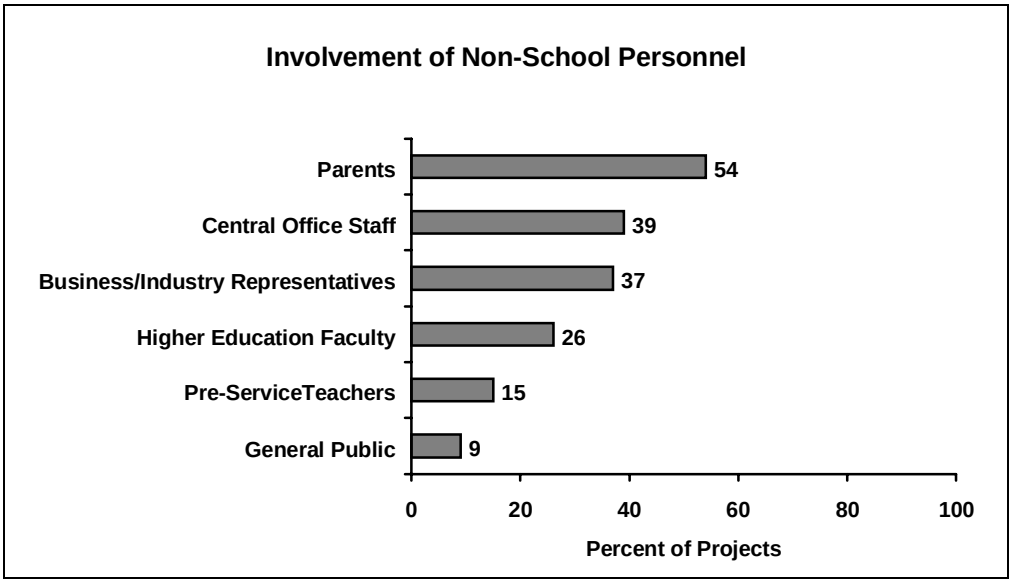

Figure 4

Description of Core Evaluation Data Collection and Analysis

HRI has worked with the National Science Foundation and PIs and evaluators of the LSC projects on the design and implementation of a core evaluation system to allow aggregating information across projects. This section describes the data collection activities associated with the core evaluation. Results for the various core evaluation questions are presented in the following chapters, followed by a summary and recommendations chapter.

LSC Core Evaluation Questions

1. What is the overall quality of the LSC professional development activities?
2. What is the extent of school and teacher involvement in LSC activities?
3. What is the impact of the LSC professional development on teacher preparedness, attitudes, and beliefs about mathematics and science teaching and learning?
4. What is the impact of the LSC professional development on classroom practices in mathematics and science?
5. To what extent are school and district contexts becoming more supportive of the LSC vision for exemplary mathematics and science education?
6. What is the extent of institutionalization of high-quality professional development systems in the LSC districts?

Data Collection

Data collection activities for the projects' 1996–97 Core Evaluation Reports were conducted from September 1, 1996 through August 31, 1997. Cohort 3 projects were collecting baseline data for their first year of funding; this was the second year of data collection for Cohort 2 projects and the third year for Cohort 1 projects. Data collection activities included the following:

1. **Observations of professional development activities**
   The core evaluation calls for projects to conduct 5–8 observations of professional development sessions each year and record their observations on standardized protocols. Evaluators were to consult with PIs on what professional development experiences were planned throughout the data collection year, and select a sample that was representative of the diversity of the project's activities. Program-wide, a total of 276 observations of professional development sessions were conducted.

2. **Classroom observations**
   HRI provided the lead evaluator of each project with a list of 10 randomly selected teachers for each targeted subject. These teachers, or their randomly selected back-ups, were to be observed in the spring of 1997. There was a total of 517 classrooms observed, including 299 classes taught by teachers who had participated in at least 20 hours of LSC professional development, and 218 classes as baseline for Cohort 3 projects. In all cases, the data were weighted to represent the total population of eligible teachers in the project.

3. **Teacher questionnaires**
   Each project was asked to administer teacher questionnaires developed for the core evaluation to a sample of 300 teachers per targeted subject; the median response rate was 84 percent. A total of 10,054 teacher questionnaires were returned to HRI, including 6,126 from K–8 science teachers; 2,347 from K–8 mathematics teachers; and 1,581 from 7–12 mathematics teachers. Weights were added to the data file to reflect the probability of each teacher's selection into the sample, adjusted for any non-response in that project.

4. **Principal questionnaires**
   Projects were also asked to administer questionnaires to the entire population of principals of targeted schools. Return rates on the principal questionnaire were generally higher than for the teacher questionnaire; a total of 1,905 principal questionnaires were returned, with a median response rate of 92 percent.

5. **Teacher interviews**
   Evaluators of each Cohort 1 and Cohort 2 project were asked to interview a sample of 10 teachers who had participated in at least 20 hours of professional development activities in that project. A total of 249 interviews were conducted among the 26 projects. About two-thirds of the interviews were conducted by phone, and the remaining one-third in person. Evaluators summarized the interview data by completing an interview summary form with both ratings and qualitative descriptions of the information provided by each teacher. Interview data from each project were weighted to reflect the total number of teachers who had participated in LSC professional development in that project.

Data Analysis

Project evaluators were asked to report their findings using guidelines developed for the core evaluation system, including responding to the six core evaluation questions. Evaluators were also asked to provide overall ratings of the quality of professional development activities, the supportiveness of the context, and the sustainability of high-quality professional development systems. In some cases, evaluators used additional information in preparing their reports, including data resulting from expanded use of the core evaluation instruments as well as information from project-specific data collection activities.

To facilitate the reporting of large amounts of survey data, and because individual questionnaire items are potentially unreliable, HRI used factor analysis to identify survey questions that could be combined into "composites."[2] Each composite represents an important construct related to

[2] See "Technical Report: Analysis of the Psychometric Structure of the LSC Surveys" by David B. Flora and A. T. Panter, L.L. Thurstone Psychometric Lab, University of North Carolina at Chapel Hill, NC for a detailed description of the factor analysis process.

one of the key evaluation questions. For example, there is a composite on the quality of LSC professional development, and several on teacher attitudes, preparedness, and classroom practice.

Once the questionnaire items associated with each composite were identified, composite scores were created. The composites are calculated as percentages of total points possible. An individual teacher's composite score is calculated by summing his/her responses to the items associated with that composite and then dividing by the total points possible. For example, if a composite is based on six survey questions asked on a five-point scale of "strongly disagree" to "strongly agree," that composite has 30 total possible points. If a teacher's raw composite score on these six items adds to 24 points, the percentage score is 80 (computed as $24 \div 30 \times 100$). A project's mean composite score is computed by averaging the scores of the individual teachers in that project.

In the results presented in this report, teachers, schools, and projects are sometimes categorized by cohort and sometimes by targeted subject (K–8 science, K–8 mathematics, or 7–12 mathematics).[3] Analyses of the impact of the LSC initiative on teachers and their teaching are typically reported by extent of teacher involvement in LSC professional development activities. Differences in proportions were tested using Chi-square procedures. Analysis of variance and t-tests were used to test the significance of differences in means of continuous variables, using the Bonferroni adjustment to compensate for the fact that multiple comparisons were performed. Differences noted in this report are statistically significant at the .05 level.

[3] In projects targeting both mathematics and science, or both elementary and secondary mathematics, questionnaire and observation data were collected separately for each "subject."