

Local Systemic Change through Teacher Enhancement

Year Six Cross-Site Report

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Appendix Table

Summary of the Impact of LSC Professional Development on Teacher Perceptions
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Acknowledgments

The core evaluation of the Local Systemic Change Initiative requires the energy, efforts, and insights of a very large number of people.

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Within HRI, in addition to the authors of this report, Alison Bowes, Scott Hanrath, Susan Hudson, and Joan Pasley were responsible for various tasks essential to the production of this report, from instrument design, to data processing and analysis, to report production.

This report would not have been possible without the efforts of the LSC project evaluators, whose work formed the basis for the analyses presented here. Special thanks are due to the thousands of teachers throughout the more than 400 participating districts who took time from their busy schedules to provide information about their mathematics and science teaching.

I. 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, 20 in 1997, 12 in 1998, 13 in 1999, and 9 in 2000 for a total of 80 projects in Cohorts 1–6.¹

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.² 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 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 section provides an overview of the LSC projects and a description of core evaluation data collection activities. Subsequent sections present the findings from the core evaluation activities conducted from September 1, 1999 through August 31, 2000.

¹ Three projects completed data collection in 1998 and six in 1999; these nine are not included in the analyses in this report.

² As of 1999, NSF requires 130 hours of all projects.

A. An Overview of LSC Projects in Cohorts 1–6

Project data sheets completed by the PIs and questionnaires completed by the principals of targeted schools provide some basic information about the LSC projects included in Cohorts 1–6.

- As of 1999–2000, the LSC initiative included 38 K–8 science projects, 5 secondary science projects, 14 K–8 mathematics projects, 14 secondary mathematics projects, 5 projects that targeted both elementary mathematics and science, and 4 projects that targeted both elementary and secondary mathematics.
- Thirty-two of the LSC projects are single-district projects; at the other end of the scale, 4 projects involve more than 20 districts each.
- Fifty-nine of the projects are five-year projects, 14 are four-year, and 7 are three-year.
- The 80 current and completed projects plan to involve a total of approximately 65,000 teachers in nearly 3,700 schools in 457 districts across the United States.
- By the completion of these projects, an estimated 2,040,000 students will receive instruction from LSC-treated teachers each year.

Participating Schools

As can be seen in Figure 1, half of the schools targeted for the LSC are in urban areas; only 11 percent are in rural areas.

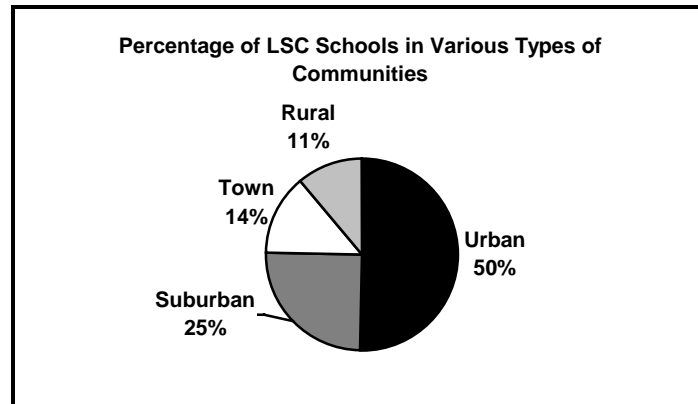


Figure 1

In terms of student demographics, across all schools targeted by the LSCs, 51 percent of students are white, 23 percent African-American, 18 percent Hispanic, 7 percent Asian, 0.3 percent Hawaiian or Pacific Islander, 1 percent American Indian or Alaskan Native and 0.5 percent are from another background. As can be seen in Figure 2, projects targeting K–8 mathematics serve the largest proportion of minority students, but in each subject the representation of minority students is far greater than the national average of approximately 30 percent.

The typical school targeted for K–8 mathematics or science reform by the LSC projects has 506 students, 53 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 6–12 mathematics or science reform has 837 students, 35 percent of whom are eligible for free or reduced-price lunches and 9 percent of whom are LEP.

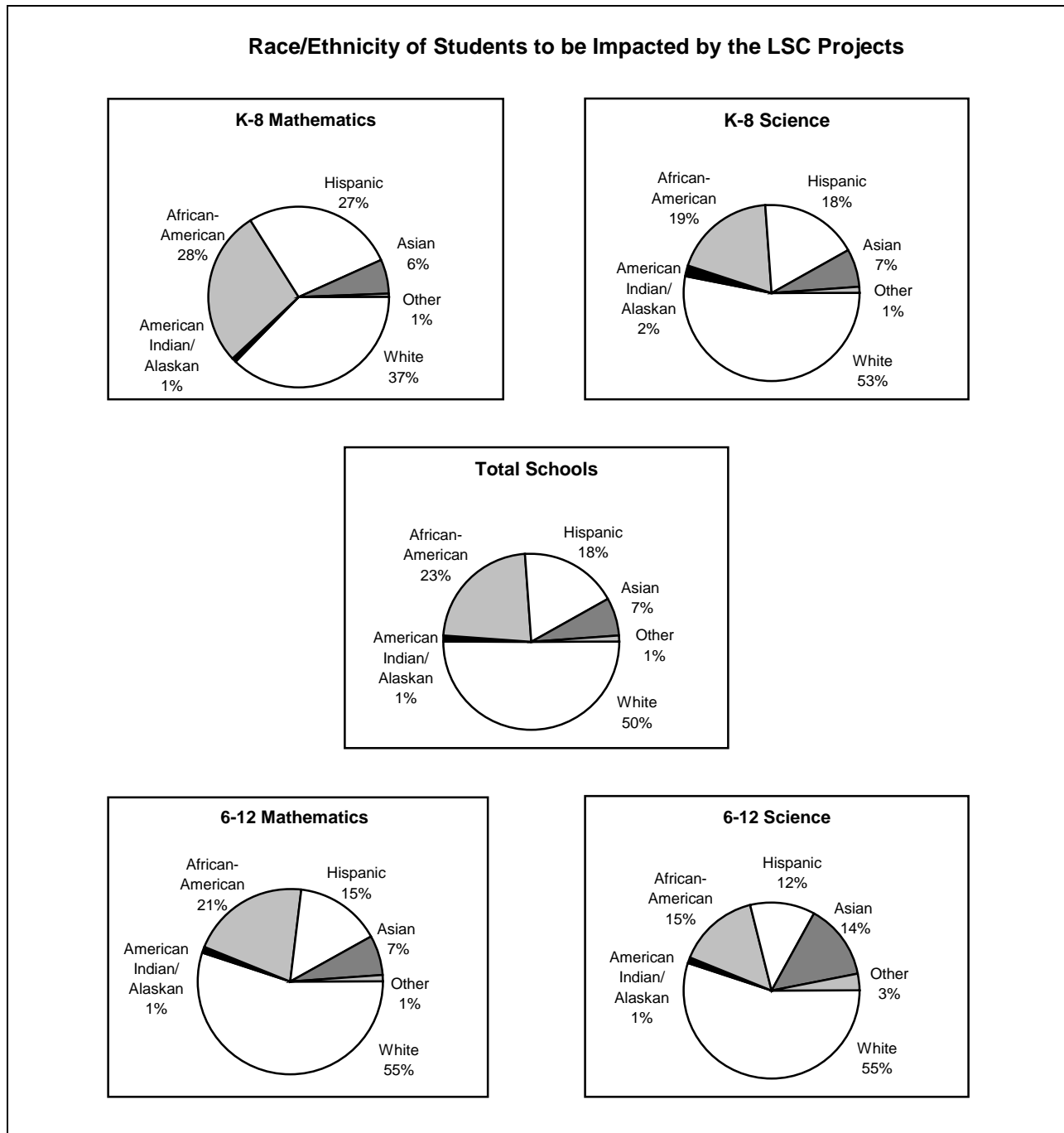


Figure 2

B. 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. Subsequent sections of the report present results for the four core evaluation questions listed below, followed by a summary and recommendations section.

LSC Core Evaluation Questions

- What is the overall quality of the LSC professional development activities?
- What is the extent of school and teacher involvement in LSC activities?
- What is the impact of the LSC professional development on teacher preparedness, attitudes, and beliefs about mathematics and science teaching and learning?
- What is the impact of the LSC professional development on classroom practices in mathematics and science?

Data Collection

Data collection activities for the projects' 1999–2000 Core Evaluation Reports were conducted from September 1, 1999 through August 31, 2000. Cohort 6 projects were collecting baseline data for their first year of funding; this was the second year of data collection for Cohort 5 projects, the third year for Cohort 4 projects, the fourth year for Cohort 3 projects, the fifth year for Cohort 2 projects, and the sixth year for Cohort 1 projects. The Core Evaluation Data Collection schedule was adjusted in 1999–2000 with the goal of transitioning to a longitudinal system. Some projects conducted less-extensive evaluation activities than in previous years, resulting in an overall smaller pool of data for some analyses. Data collection activities included the following:

1. Observations of Professional Development Activities

The core evaluation called for projects to conduct observations of professional development sessions and record their observations on standardized protocols. Established projects were required to conduct 5–8 observations; baseline projects conducted 2–5 observations. 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 423 observations of professional development sessions were conducted. Data were weighted to control for the variable number of observations conducted per project.

2. *Classroom Observations*

Fifty-eight of the 71 active projects were scheduled to conduct classroom observations, with the number of observations ranging from 6 to 16. These randomly selected teachers, or their back-ups, were to be observed in the spring of 2000. There was a total of 642 classrooms observed, roughly half of which were taught by teachers who had participated in at least 20 hours of LSC professional development. In all cases, the data were weighted to represent the total population of eligible teachers in the project.

3. *Teacher Questionnaires*

Thirty-two projects administered teacher questionnaires developed for the core evaluation to a random sample of teachers for each targeted subject; the median response rate among projects was 82 percent. A total of 8,016 teacher questionnaires was returned to HRI, including 4,104 from K–8 science teachers; 3,138 from K–8 mathematics teachers; 593 from 6–12 mathematics teachers; and 181 from 6–12 science 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*

All projects were 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 3,412 principal questionnaires were returned, with a median response rate among projects of 95 percent.

5. *Teacher Interviews*

Evaluators 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 580 interviews were conducted among 58 projects. Sixty-nine percent of the interviews were conducted by phone, and 31 percent were conducted in person. Evaluators summarized the interview data by completing an interview summary form with both ratings and direct quotations from the participating teachers. 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

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.”³ Each composite represents an important construct related to one of the core evaluation questions. For example, there is a composite on the quality of LSC professional development, and several on teacher attitudes, preparedness, and classroom practice.

³ See “Technical Report: Analysis of the Psychometric Structure of the LSC Surveys” (12/07/98) 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 procedure.

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 6–12 mathematics).⁴ 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 0.05 level.

⁴ In projects targeting both mathematics and science, or both elementary and secondary mathematics, questionnaire, observation, and interview data were collected separately for each "subject." Data from the five projects that target secondary science teachers are included in the overall results for "all teachers," but they are not reported separately because of the small sample size.

II. Quality of LSC Professional Development

A. Introduction

For the core evaluation, project evaluators were asked to observe 5–8 professional development activities in each ongoing project and at least two in each project that had just begun its professional development. Evaluators and PIs were to decide jointly which activities would be observed, selecting sessions to represent the diversity of the project’s professional development offerings and to reflect the extensiveness and importance of the various kinds of activities. A total of 423 professional development sessions were observed.

This section of the report presents a summary of data collected from observations of individual sessions across all LSC projects, including descriptive information about the observed sessions and evaluators’ assessments of their quality. Evaluators observed all or parts of additional professional development activities without completing core evaluation protocols, and interviewed teachers about their professional development experiences, using project-specific protocols, as well as the core evaluation teacher interview protocol. The section concludes with teacher and evaluator judgements of the overall quality of the LSC professional development programs.

B. Description of LSC Professional Development Sessions

Evaluators documented a number of descriptive features of each professional development session, providing information about targeted participants, presenters/facilitators, purposes and content focus, and the major types of activities that characterized the sessions.

Participants

The typical professional development session observed for the LSC core evaluation included between 11 and 20 participants; only 2 percent of the sessions had more than 100 participants. Some sessions exclusively targeted teacher leaders (25 percent); most sessions targeted only regular teachers (79 percent); and some sessions targeted both lead and regular teachers (11 percent). A total of 10 percent of the sessions included principals or other administrators.

Presenters/Facilitators

As noted earlier, LSC professional development involves presenters/facilitators from a variety of settings. District personnel served in this capacity in 76 percent of the observed sessions, while only 32 percent of the sessions included university faculty as presenters or facilitators. (See Figure 3.) Across all of the observed sessions, three-fourths of the presenters/facilitators were female and one-fourth, male. As can be seen in Figure 4, 85 percent of the presenters/facilitators were white and 15 percent members of other race/ethnic groups.

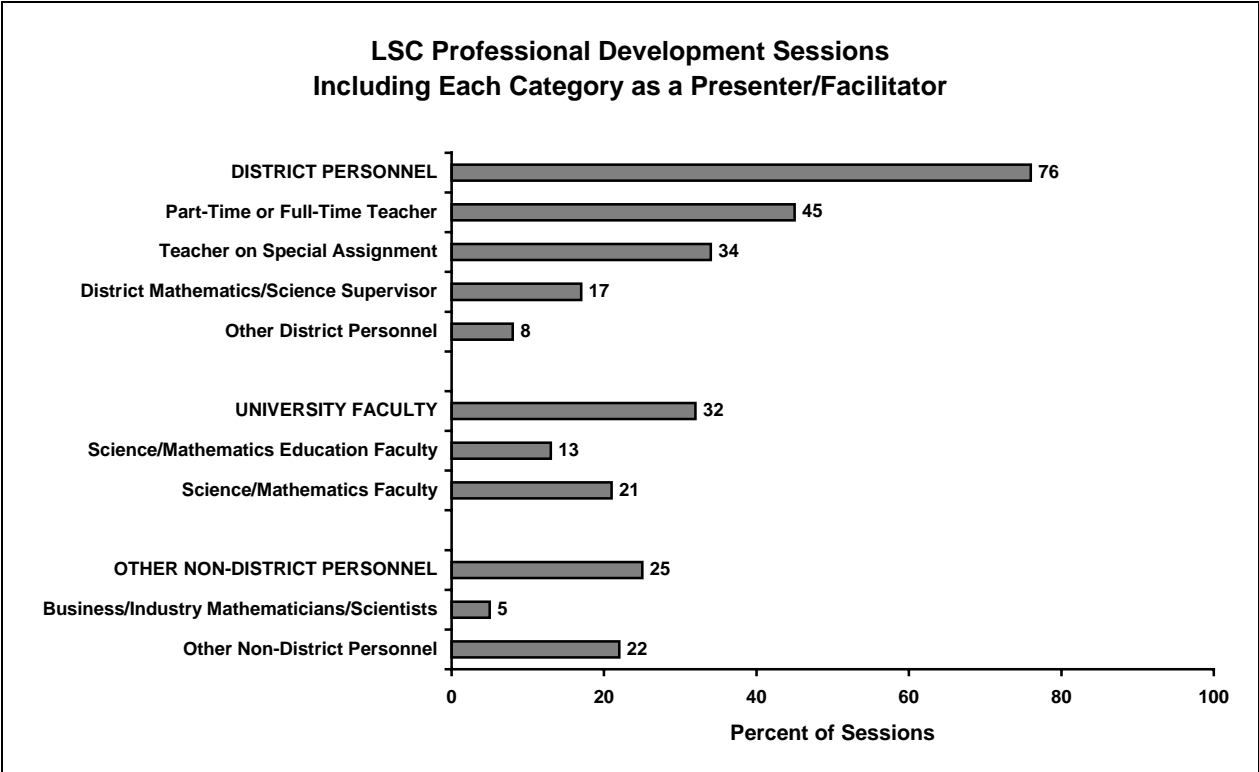


Figure 3

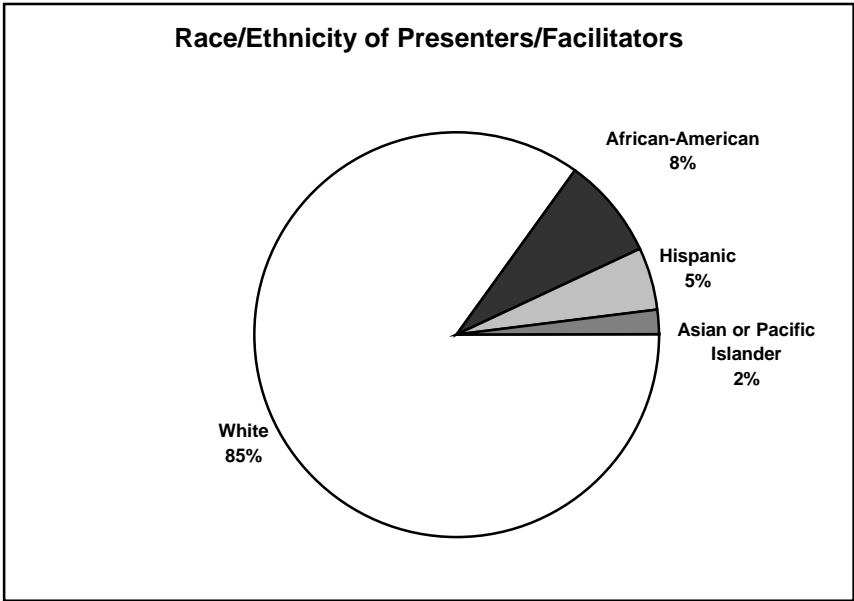


Figure 4

Purposes of the Professional Development Sessions

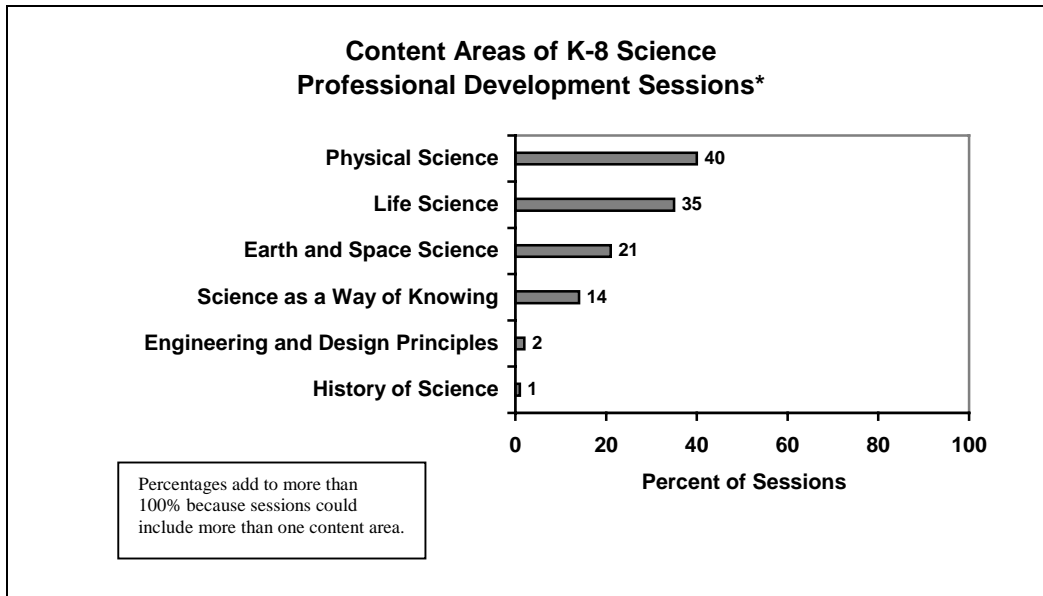
Evaluators were asked to indicate the major intended purposes of each observed session based on information provided by the session facilitators. The results were nearly identical to those reported in the previous year. As can be seen in Table 1, the most frequently cited purposes were learning how to use specific instructional materials (44 percent), and enhancing teachers’ understanding of mathematics/science concepts (43 percent).

**Table 1
Major Intended Purposes of LSC Professional Development Sessions**

	Percent of Sessions			
	All Sessions	K-8 Science	K-8 Mathematics	6-12 Mathematics
Learning how to use specific instructional materials	44	42	47	47
Increasing teacher mathematics/science content knowledge	43	44	44	45
Learning pedagogical/classroom management strategies	31	31	31	28
Creating a vision of effective mathematics/science instruction	30	33	24	24
Understanding student thinking/learning about mathematics/science content	30	28	38	20

Content Focus of Professional Development Sessions

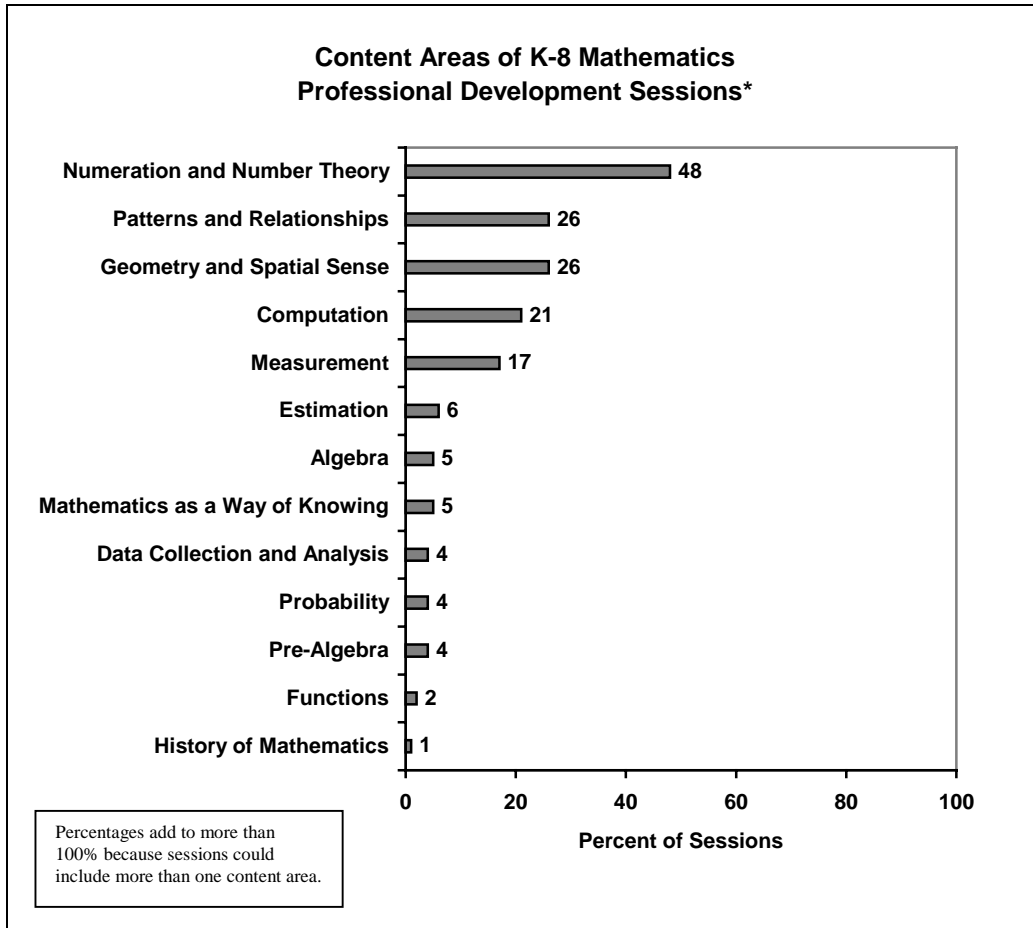
When sessions focused on one or more disciplinary content areas, evaluators were asked to categorize that content. In K–8 science projects, evaluators reported that the majority of the sessions had a disciplinary content focus dealing with physical science concepts (40 percent) followed closely by life science content (35 percent); far fewer addressed concepts from earth and space sciences (21 percent) or “science as a way of knowing” (14 percent). Only 2 percent of the observed K–8 sessions focused on engineering concepts, and 1 percent emphasized the history of science.



* Only sessions that focused on disciplinary content were included in these analyses.

Figure 5

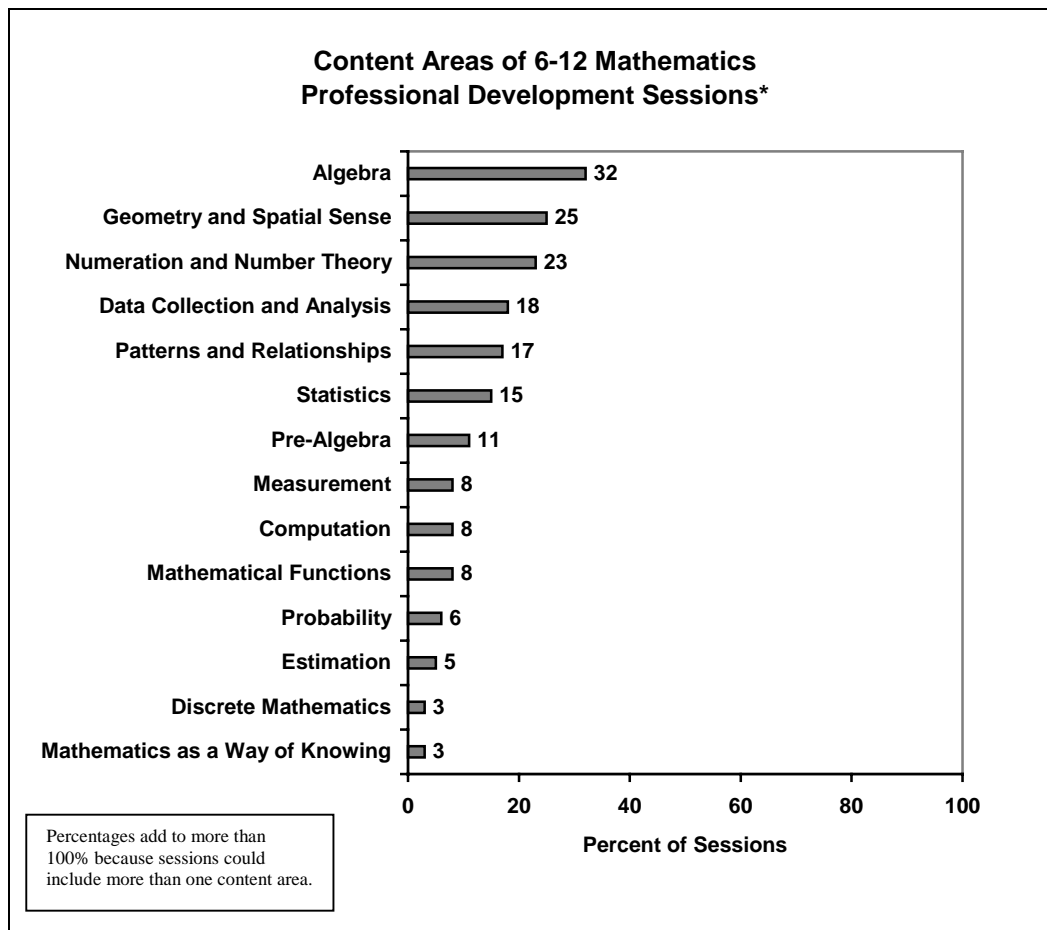
In projects targeting K–8 mathematics, the most heavily emphasized topics were numeration and number theory (48 percent of the sessions that dealt with disciplinary content), patterns and relationships (26 percent), geometry and spatial sense (26 percent), and computation (21 percent).



* Only sessions that focused on disciplinary content were included in these analyses.

Figure 6

As can be seen in Figure 7, algebra was the most commonly emphasized content area in sessions for 6–12 mathematics teachers, with 32 percent of the sessions that dealt with disciplinary content focusing on algebra. Roughly 1 in 4 content sessions focused on geometry and spatial sense, similar to the percent focusing on numeration and number theory. A number of other areas—data collection and analysis, patterns and relationships, statistics, and pre-algebra—were each the focus in 11–18 percent of the 6–12 mathematics content sessions.



* Only sessions that focused on disciplinary content were included in these analyses.

Figure 7

Session Activities

The typical professional development session observed as part of the LSC core evaluation included several different types of activities. As can be seen in Table 2, most sessions included discussions or seminars (81 percent), two-thirds of the sessions engaged participants in problem-solving or investigation, and more than one-third included formal presentations, usually by project staff as opposed to participants. Fewer of the observed sessions involved participants in reading (6 percent) or writing (4 percent) about disciplinary content, pedagogy or reform issues.

Table 2
Major Activities of LSC Professional Development Sessions

	Percent of Sessions			
	All Sessions	K-8 Science	K-8 Mathematics	6-12 Mathematics
Engaged in discussions/seminars	81	84	84	69
Whole group led by facilitator	69	71	70	63
Whole group led by participants	8	8	8	6
Small groups/pairs	37	35	46	28
Engaged in problem-solving/investigation	66	66	61	72
Listened to a formal presentation	39	43	29	32
By presenter/facilitator	38	43	28	30
By participants	3	1	2	4
Read about disciplinary content, pedagogy, or reform issues	6	5	9	9
Wrote about disciplinary content, pedagogy, or reform issues	4	6	2	4

C. Quality of LSC Professional Development Sessions

In order to assess the quality of professional development sessions, evaluators were asked to rate a number of components for each session they observed, including the:

- Design of the session;
- Implementation of the professional development activities;
- Quality of the disciplinary, pedagogical, and/or leadership content; and
- Culture of the session.

For each component area, observers first rated a series of individual indicators of best practice in professional development for standards-based mathematics/science education. These indicators were rated on a scale ranging from 1, “not at all” to 5, “to a great extent” to document the extent to which that feature characterized the observed professional development session.

Considering those “on-ramp” indicators, observers then assessed the overall quality of each component area. The lowest rating for component areas (Level 1) indicated that the session was not at all reflective of best practice. The highest rating (Level 5) indicated that the particular component of the session was extremely reflective of best practices for standards-based mathematics and science education.⁵ Evaluators’ ratings of the component areas are presented in the following sections.

⁵ Copies of the Professional Development Observation Protocol may be found in the Data Collection Manual section of the HRI web site: <http://www.horizon-research.com/LSC>.

Design of Professional Development Sessions

As noted above, observers assessed the design of professional development sessions by rating a series of individual indicators based on current understandings of best practice. Several of these indicators received high ratings (4 or 5 on a five-point scale) in many of the observed sessions. Those indicators that were most often highly rated included:

- The extent to which the session encouraged a collaborative approach to learning (80 percent);
- The extent to which the session design reflected careful planning and organization (77 percent); and
- The extent to which the session provided opportunities for teachers to consider classroom application of resources, strategies, and techniques (76 percent).

Fewer sessions were rated highly on:

- The extent to which the session built on participants' knowledge of content, teaching, learning, and/or the reform process; and where it provided time and structure for the sharing of experiences and insights (65 percent);
- Providing adequate time and structure for reflection (59 percent); and
- Providing adequate time and structure for wrap-up/closure (58 percent).

Observers found that the designs of the majority of the professional development sessions were quite reflective of best practice. As indicated in Figure 8, 69 percent of the professional development sessions received overall design ratings of 4 or 5.

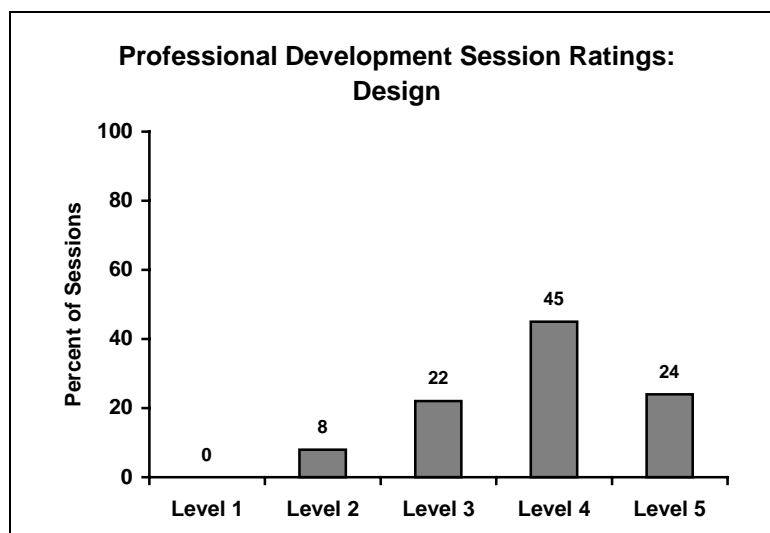


Figure 8

Implementation of Professional Development Sessions

Observers also assessed the quality of implementation of professional development sessions. Indicators most frequently rated 4 and 5 were:

- Whether the facilitator’s contributions during the course of the session enhanced the quality of the session (74 percent); and
- Whether the facilitator’s background and expertise enhanced the quality of the session (74 percent).

As has been the case in previous years, fewer LSC professional development sessions were rated highly on such indicators as:

- How well the session modeled questioning strategies that are likely to enhance the development of conceptual understanding (53 percent); and
- How well the session modeled effective assessment strategies (48 percent).

As indicated in Figure 9, 62 percent of the sessions received overall ratings of 4 or 5 on their quality of implementation.

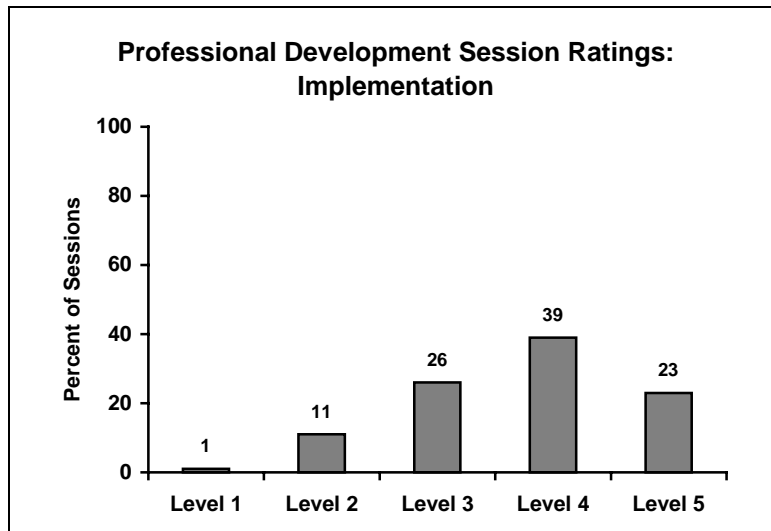


Figure 9

Professional Development Culture

The literature on effective staff development emphasizes the importance of establishing a professional development culture where teachers can explore content and pedagogy in a collegial, risk-free environment. As can be seen in Figure 10, 73 percent of the sessions received synthesis ratings of 4 or 5 in this area. Indicators that were most likely to receive high ratings included:

- The extent to which there was a climate of respect for participants' experiences, ideas, and contributions (84 percent); and
- Whether active participation of all was encouraged and valued (81 percent).

Fewer sessions were highly rated on:

- The extent to which intellectual rigor, constructive criticism, and the challenging of ideas were valued (68 percent); and
- The extent to which investigation and risk-taking were valued (57 percent).

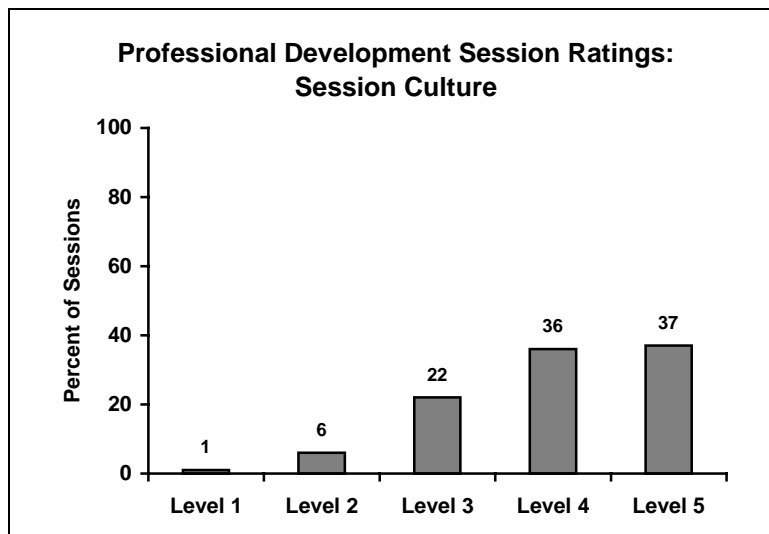


Figure 10

Disciplinary and Pedagogical Content

Evaluators were asked to rate either the quality of the disciplinary content of the observed session, its pedagogical content, or both, depending on the focus of the session. Disciplinary content was rated in 300 of the 423 sessions, with 70 percent of these sessions receiving overall ratings of 4 or 5 in this area. (See Figure 11.) Disciplinary content sessions were most likely to receive high ratings for:

- The extent to which the facilitators displayed an understanding of mathematics/science content (82 percent); and
- The appropriateness of the disciplinary content for the purposes of the session and the background of the participants (81 percent).

As has been the case in previous years, fewer sessions received high ratings on:

- Whether the degree of closure of conceptual understanding was appropriate for the purposes of the session (59 percent).

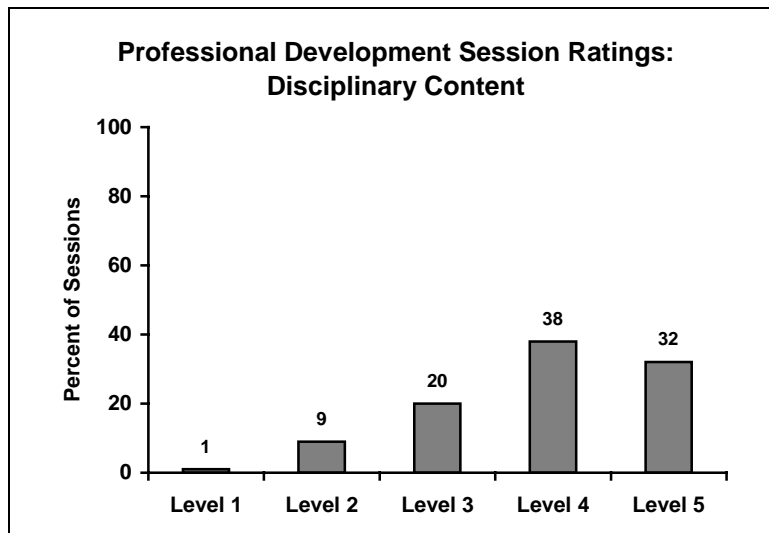


Figure 11

Observers rated 335 of the 423 observed professional development sessions on the quality of their pedagogical content. As can be seen in Figure 12, 63 percent of professional development sessions received ratings of 4 or 5 for overall pedagogical content.

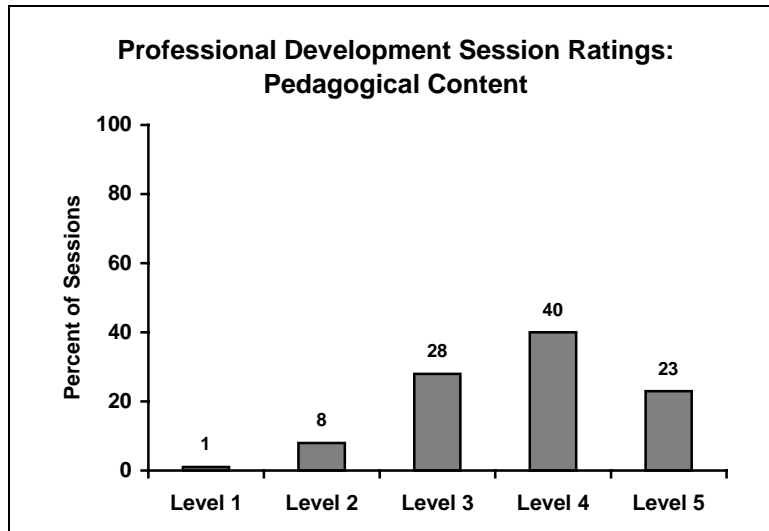


Figure 12

Within the area of pedagogical content, sessions were rated most highly for the depth and breadth of attention to student instructional materials (72 percent) and the extent to which the facilitators displayed an understanding of pedagogical concepts (71 percent received high ratings). In contrast, only 57 percent of the sessions were rated highly for their handling of closure/resolution of understanding of pedagogical concepts, the same area that was weakest in previous years.

Overall Assessment of Observed Professional Development Sessions

Observers were asked to consider all information available to them—their own ratings of session components, related interviews, and their knowledge of the project’s professional development program—as they assessed the overall quality of each observed session. Observers first considered the likely impact of the session on participants’ capacity for exemplary mathematics/science instruction, or the likely impact on leadership capacity when leadership development was a focus of the session instruction. They then assigned a “capsule rating” to characterize the overall quality of the professional development session. Ratings on a five-point scale ranged from “ineffective professional development” (Level 1) to “exemplary professional development” (Level 5).

Sessions’ Impact on Participants’ Capacity for Exemplary Mathematics/Science Instruction

Observers rated the likely impact of each session on teachers’ capacity for exemplary mathematics/science instruction. According to these observers, LSC professional development sessions were most likely to have a positive effect on participants’ ability to: (1) plan and implement high-quality classroom instruction (74 percent); (2) network with other teachers about instruction (72 percent); (3) implement exemplary classroom instructional materials (71 percent);

(4) identify and understand important content ideas (69 percent); and (5) exhibit self-confidence as mathematics/science instructors (69 percent). Fewer sessions were judged likely to have a positive effect on participants' understanding of how students learn (60 percent); the same area that was rated least highly in the previous year.

Quality of Leadership Development Sessions

Many LSC projects incorporate the use of teacher leaders in their professional development strategies. When evaluators observed professional development sessions that focused on the preparation of teacher leaders, as did 68 of the 423 observed sessions, they were asked to rate a number of key indicators in the area of leadership content. As can be seen in Figure 13, 57 percent of the sessions focusing on leadership content received a high synthesis rating (4 or 5) in this area. Leadership sessions were most likely to receive high ratings for:

- The extent to which participants were intellectually engaged with important leadership content (69 percent);
- The extent to which facilitators demonstrated an understanding of leadership concepts (68 percent); and
- How well principles of effective staff development were presented/explored (60 percent).

Sessions focusing on leadership concepts were less likely to receive high ratings for:

- Quality of information on strategies for mentoring/coaching peers (54 percent); and
- Quality of information on how to be a reform advocate at the school/district level (50 percent).

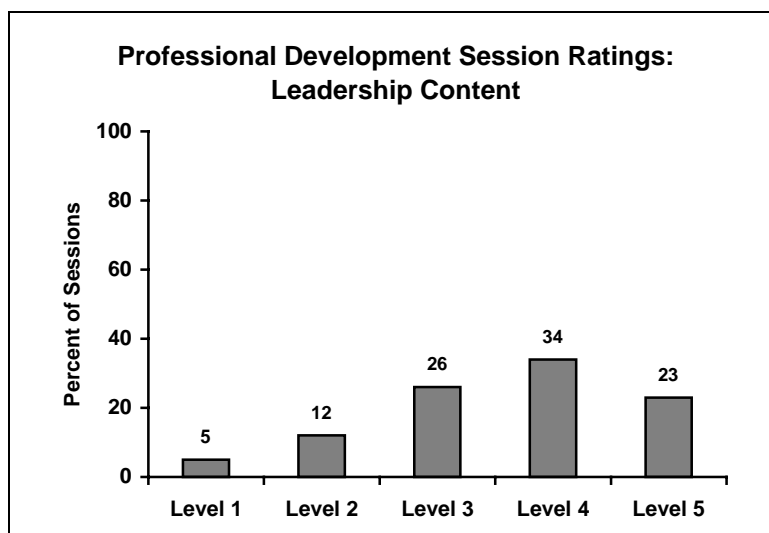


Figure 13

When asked about the likely impact of the sessions on participants' leadership capacity, evaluators were most likely to cite leaders' knowledge and understanding of mathematics/science; knowledge and understanding of effective classroom practice; professional networking among teacher leaders; and participants' confidence in serving in leadership roles, with over 2 out of 3 sessions deemed to have had a positive impact in these areas. In contrast, fewer than half of leadership sessions were judged likely to have a positive effect on teacher leaders' understanding of adult learners, or on their understanding of teachers' prior knowledge.

Capsule Ratings of Observed Professional Development Sessions

As would be expected given the high ratings assigned by evaluators for the various components, overall ratings for individual professional development sessions were quite favorable. Only 1 percent of observed LSC sessions were rated as ineffective professional development (Level 1), and 6 percent were rated at Level 2, having quite limited likelihood of helping participants implement exemplary mathematics/science instruction or be leaders in reform. Overall, 55 percent of the observed professional development sessions received ratings of 4 or 5, indicating that those sessions were skillfully facilitated, engaging participants in purposeful work that would likely lead to enhanced capacity to implement exemplary instruction. (See Figure 14.)

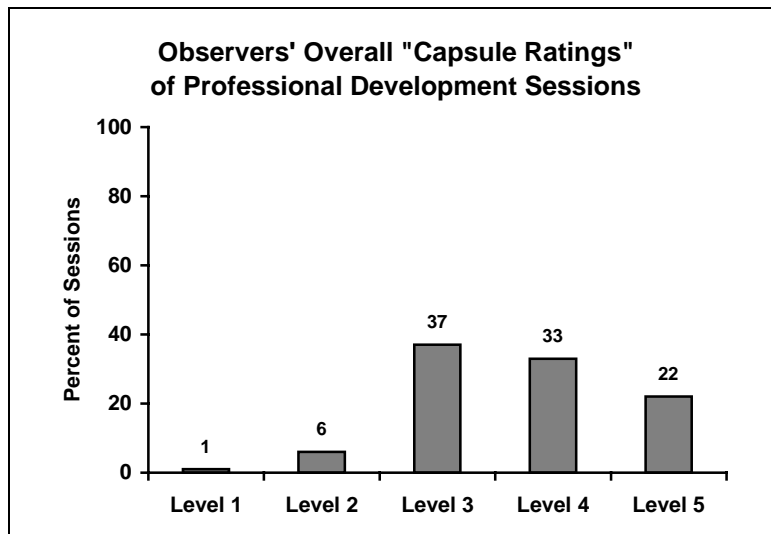


Figure 14

D. Teacher Perceptions of the Overall Quality of LSC Professional Development Programs

As part of the core evaluation, each year a sample of teachers is asked about the overall quality of the LSC professional development. In the spring of 2000, 580 teachers who had participated in 20 hours or more of LSC professional development were interviewed by project evaluators. In addition, 5,854 teachers who had participated in LSC professional development answered survey questions about the quality of those experiences.

Teachers who indicated they had participated in LSC professional development were asked to respond to a series of statements about those experiences. Table 3 shows that overall, fewer than one-third of the teachers who have participated in the LSC indicated that they were given considerable time to work with other teachers and to reflect on how to apply what they are learning to their classrooms. Teachers were more likely to indicate that they receive considerable support for implementation, with 44 percent doing so.

Table 3
Teacher Responses to Statements about LSC Professional Development

	Percent of Teachers Assigning High Ratings*			
	All Teachers	K-8 Science	K-8 Mathematics	6-12 Mathematics
I am given time to work with other teachers as part of my professional development.	27	26	28	29
I am given time to reflect on what I've learned and how to apply it to the classroom.	28	26	29	27
I receive support as I try to implement what I've learned.	44	44	44	48

* Includes teachers indicating 4 or 5 on a five-point scale ranging from 1 "not at all" to 5 "to a great extent."

Table 4 shows teacher ratings of LSC professional development programs overall, with 8 percent of teachers rating the professional development programs "poor" or "very poor," 52 percent "fair" or "good," and 40 percent "very good" or "excellent."

Table 4
Teacher Ratings of LSC Professional Development Programs Overall

	Percent of Teachers					
	Very Poor	Poor	Fair	Good	Very Good	Excellent
K-8 Science	1	4	18	27	32	17
K-8 Mathematics	4	7	29	31	20	8
6-12 Mathematics	3	4	24	33	25	11
All Teachers	3	6	23	29	27	13

Figure 15 shows the percent of teachers in each of three subject and grade range combinations who rated LSC professional development “very good” or “excellent” in the 2000 questionnaire, analyzed by level of treatment. Note that the greater the level of participation, the higher the ratings. Similarly, Figure 16 shows the results on a composite variable on quality of the LSC professional development created from teachers’ responses to several items on the questionnaire. Again, the more hours of participation in LSC professional development, the higher the ratings of quality.

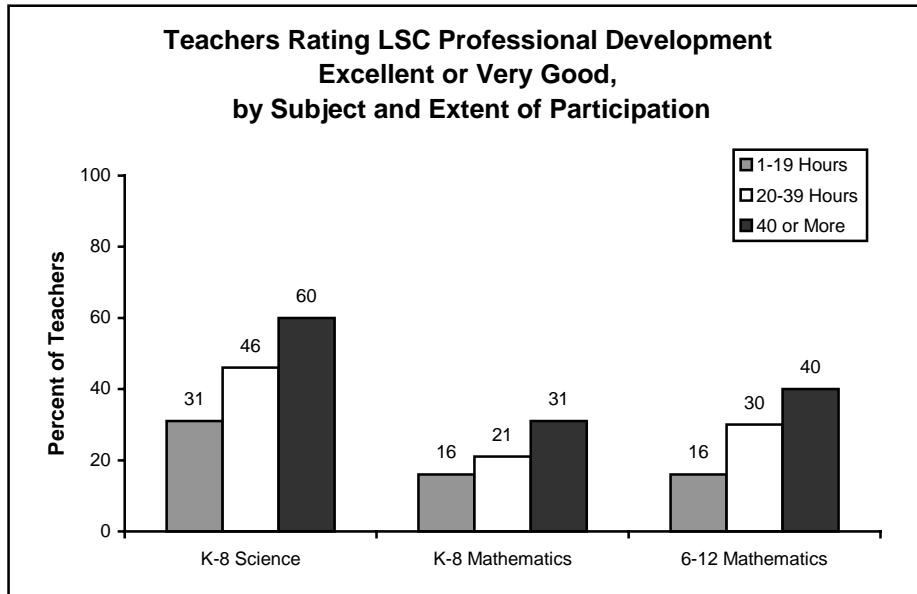


Figure 15

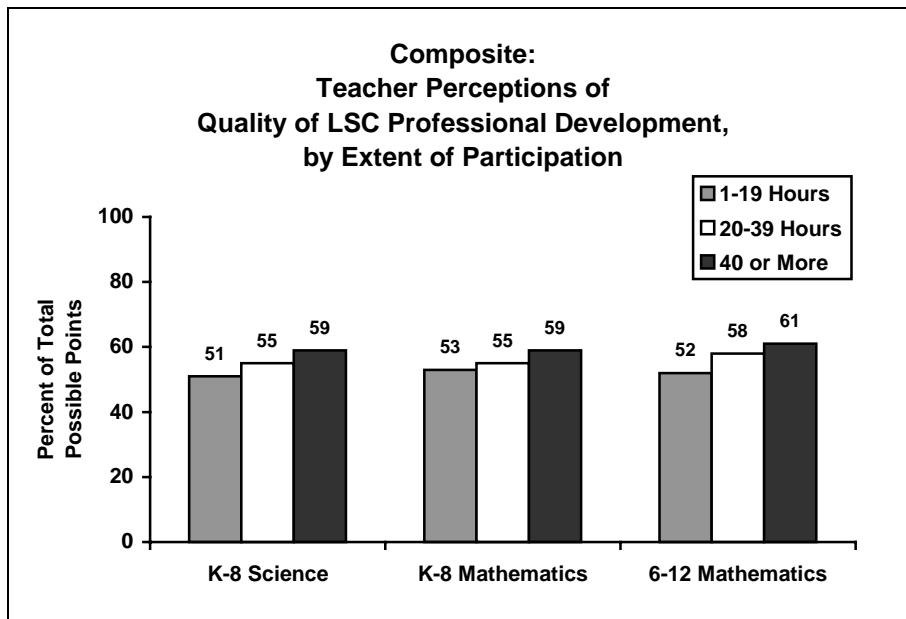


Figure 16

Teacher interviews yielded a similar finding. Evaluators asked a random sample of teachers who had participated in the LSC professional development for at least 20 hours to talk about their experiences in the program and used these responses to characterize each teacher's opinions on a five-point scale from very negative to very positive. Overall, 60 percent of teachers who had participated in 60 or more hours of LSC professional development had highly positive opinions of the LSC program, compared to 50 percent of those with lower levels of participation.

When asked about the impact of the LSC, about half of these teachers talked about how the LSC had made them better prepared for mathematics/science teaching; slightly fewer spoke about how the LSC had enabled them to change their classroom practice. Interestingly, many more teachers cited improvements in relation to their instructional strategies and use of the designated materials than cited improvements in content, either their own content knowledge or the content of their classroom instruction. Typical comments included:

Increased Preparedness

I love the kits. The materials are great. I don't have to go out and design my own science unit; it's all there, it's all interconnected, I can expand on things from it. It's easy; I've got the lessons; it's all right there for me to use.

I have gained a greater understanding of the content of the math topics covered...I finally really understand what we're doing in algebra. I saw the shallowness of how we were teaching.

I noticed a big difference between last year, when I taught the kit without professional development, and this year (after the workshop). I was much more confident because the workshops helped me to improve my understanding of the content and I could share that with the students.

Changed classroom practice

Now the children are more involved in deciding where we go. I follow the lesson plan in the kit, but we expand on it. If they have questions, we go with it.

I just don't feel as nervous about trying to figure things out now. I attempt it better. I guess I can relate to the kids better now. I just know how important the alternative types of math are for kids. I think that I do more of a rounded math curriculum myself. I get a lot of hands-on. If we're going to measure, we get out the measuring tape, we get out the rulers, and we get out the meter sticks and all the rest of that.

I made changes in my teaching style; less lecture, kids worked together more, more student inquiry and problem-solving. I didn't just stand up and tell them what to do. This transferred over to my classes that used a traditional curriculum.

When asked about the "most helpful" aspects of the LSC, nearly all of the teachers cited at least one benefit. About one-third of the teachers cited the high quality of the LSC professional

development, while roughly one-fourth talked about the opportunities to collaborate with other teachers and to deepen their knowledge of how to use the designated instructional materials. Mathematics teachers were more likely than science teachers to talk about the utility of the LSC in helping them understand pedagogy and how students learn, while science teachers were more likely to cite getting the materials they need for instruction as the “most helpful.”

While roughly 1 in 4 teachers indicated that everything about the LSC was helpful, others cited one or more concerns. Problems with the designated instructional materials topped the list of “least helpful” aspects of the LSC. In the case of science teachers, the time required to implement the materials and the logistics of materials management were most frequently cited, while mathematics teachers were more likely to talk about inadequate attention to fundamental mathematics concepts:

The curriculum was not realistic about time requirements. I was always having to edit the lessons, to cut them down to a more realistic time frame.

Some of the scheduling to use the materials did not coincide with when we needed them. The availability of kits was a problem. Since teachers must share kits across the district, not every school can have them when appropriate. It didn't spend enough time on developing specific skills. Students need more practice. There were not enough problems to reinforce skills.

There's not enough emphasis on basic skills. They don't mention the formulas.

It covered some concepts, but did not cover other concepts that we have to teach. There is not enough drill in the workbooks and practice sheets. The old-fashioned basics: it's all missing. It's good ideas and solving problems, but you can't do that and still drill the basics.

Others expressed concern about the quality or applicability of the professional development and the time commitment required:

The activities in the workshops didn't translate directly into the classroom. They were interesting and worthwhile and might be useful in some classrooms but not at my level.

Overall the kit trainings are good but I feel that there are far, far, far too many hours expected of teachers. They could be shortened. I don't feel I need quite as much training as they think I need. The manuals are there; it's nice to get an overall view, but I don't always feel like I need to do so many lessons myself. It's too many hours; it's draining.

Being pulled out during the school day for workshops seems to cause problems at my school. The principal's attitude is negative. There are also problems getting substitutes at my school. My kids usually get out of hand, and it takes a few days to get my low-performing students back on task after training. I would like to see after-school and Saturday workshops.

Almost all of the teachers cited at least one area of need for additional help in improving instruction. Teachers typically requested “more” of what they were already getting: more professional development in pedagogy, technology, and in the use of the designated materials, more academic year support, and more time for networking with other teachers. Typical comments included:

I would like to have more training on specific kits . . . because some things you are knowledgeable in like anything and in some things you lack knowledge. . .

I need more experience and training for how to incorporate technology in my teaching.

[I need] help with learning different types of cooperative techniques to use this book. I know there are a whole lot that I don't use.

We need more workshops for follow up. Maybe before we teach a unit we could meet with all the grade level teachers in the district and review the kits, learn how other teachers used assessments and other ideas they may have. New teachers really need this training. Also, we should have it each time a kit is new to the grade level.

We need continued time during the year to follow up with teachers and touch base as we are using the materials. There's a lot of anxiety with a new program.

E. Evaluator Ratings of the Quality of LSC Professional Development Programs

Based on the results of their observations, as well as feedback from participating teachers, evaluators rated the overall quality of the LSC professional development in a number of areas, including preparing project staff to carry out their roles in providing professional development to targeted teachers; the quality of the professional development culture; the project’s overall treatment of disciplinary and pedagogical content; and the nature and extent of support provided to teachers during implementation.

Preparedness of Professional Development Providers

As can be seen in Figure 17, overall, 80 percent of LSC projects received high ratings (4 or 5 on a five-point scale ranging from 1 “inhibited effective professional development” to 5 “facilitated effective professional development”) for the quality of their efforts in preparing professional development providers.

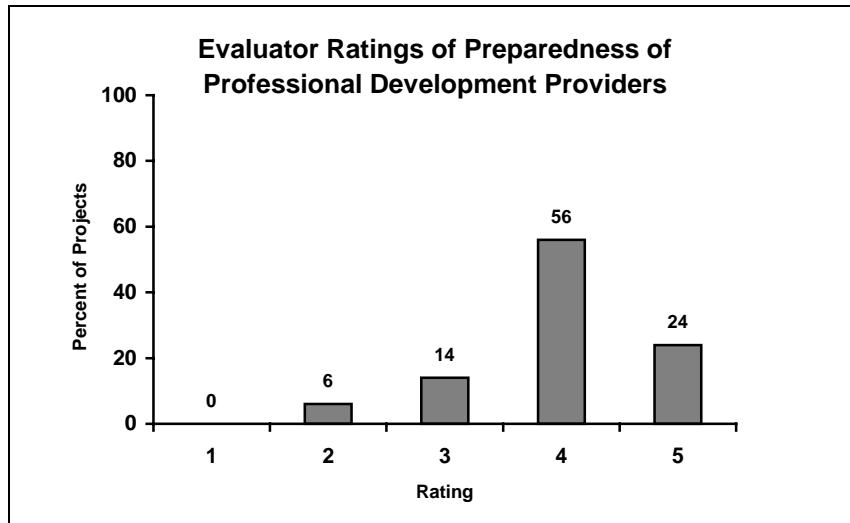


Figure 17

Professional Development Culture

Using all of the information available to them, including teacher comments and their own observations, evaluators rated the overall success of each project in creating a climate conducive to teacher learning. Overall, 83 percent of projects received ratings of 4 or 5 in this area. (See Figure 18.)

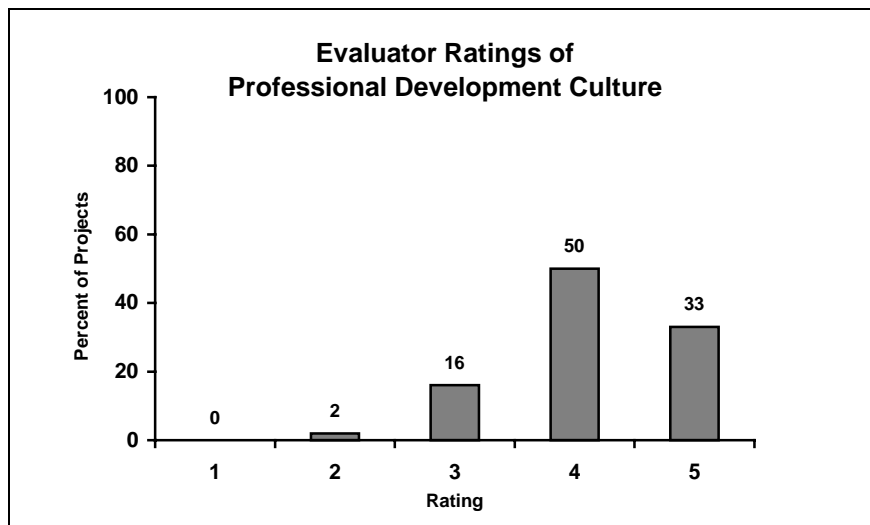


Figure 18

Treatment of Disciplinary Content

When they prepared their annual reports, evaluators considered the data they had from observations, interviews, and questionnaires and came up with an overall rating of the quality of the project's treatment of disciplinary content. As can be seen in Figure 19, only 53 percent of

projects received high ratings (4 or 5 on a five-point scale ranging from 1 “poor” to 5 “excellent”) in this area, and 8 percent received ratings below 3.

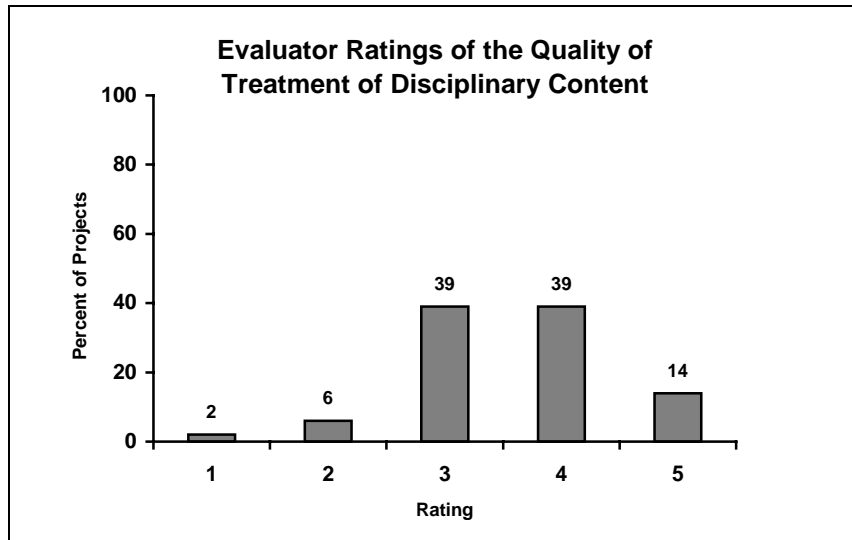


Figure 19

Treatment of Pedagogical Content

In addition to describing the quality of the project’s treatment of pedagogical content, the lead evaluator was asked to provide an overall rating in this area. As can be seen in Figure 20, 67 percent of projects received ratings of 4 or 5 in this area.

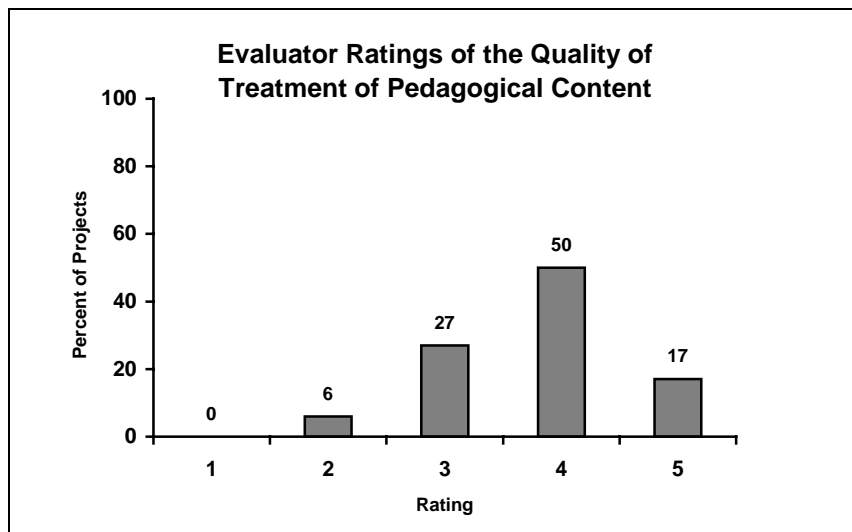


Figure 20

Support for Teachers During Implementation

Based on interview, observation, and questionnaire data, evaluators provided an overall rating of the quality of the follow-up support provided to teachers as they implemented the instructional materials in their classrooms. As can be seen in Figure 21, overall, only 53 percent of projects received high ratings in this area; 8 percent received a rating below 3 on a five-point scale.

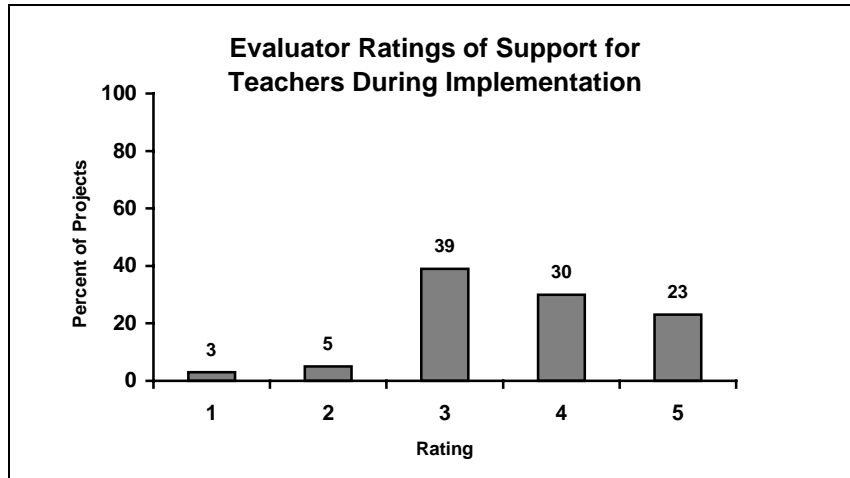


Figure 21

Continuum Ratings

At the close of the data collection year, evaluators were asked to use all of the information available to them to place the project on a continuum, from predominance of ineffective professional development, through various stages of improvement, to a system of predominantly well-designed professional development. As can be seen in Table 5, most LSC projects were rated as either transitioning to quality professional development or having an emerging infrastructure of well-designed professional development.

Table 5
Continuum Ratings for Quality of LSC Professional Development

	Percent of Projects*			
	All Projects	K-8 Science	K-8 Mathematics	6-12 Mathematics
Level 1: Predominance of Ineffective Professional Development	0	0	0	0
Level 2: Exploring Quality Professional Development	3	0	0	0
Level 3: Transitioning to Quality Professional Development	36	44	33	29
Level 4: Emerging Infrastructure of Well-Designed Professional Development	52	50	52	64
Level 5: Predominance of Well-Designed Professional Development	9	6	14	7
Mean Continuum Rating Level	3.7	3.6	3.8	3.8

* Projects that address two subject areas are included in each subject, but counted only once in the total of all projects.

III. Impact of the LSC on Teacher Preparedness, Attitudes, and Beliefs

The “theory of action” underlying the Local Systemic Change initiative argues that providing teachers with well-designed opportunities to deepen their content and pedagogical knowledge in the context of high-quality instructional materials will result in better prepared teachers. When these teachers are also given support in using these instructional materials, the theory predicts, they will be both inclined to change their teaching in ways advocated by national standards, and have the capability of doing so. Improved instruction, in turn, will lead to higher student achievement.

Participating in LSC professional development impacted teachers’ attitudes and beliefs about mathematics/science education in a variety of ways, prompting them to re-evaluate their own practice as well as their perceptions about mathematics and science teaching. The reflection time built into high-quality professional development sessions gave teachers the opportunity to process what they had learned about content and pedagogy, and to examine their evolving beliefs about teaching and learning. Still, many teachers continue to feel under-prepared in these areas.

Teacher questionnaire data indicate that secondary teachers are more likely than elementary teachers to favor grouping of students by ability levels, and that this support decreases as hours of professional development increase. (See Figure 22.)

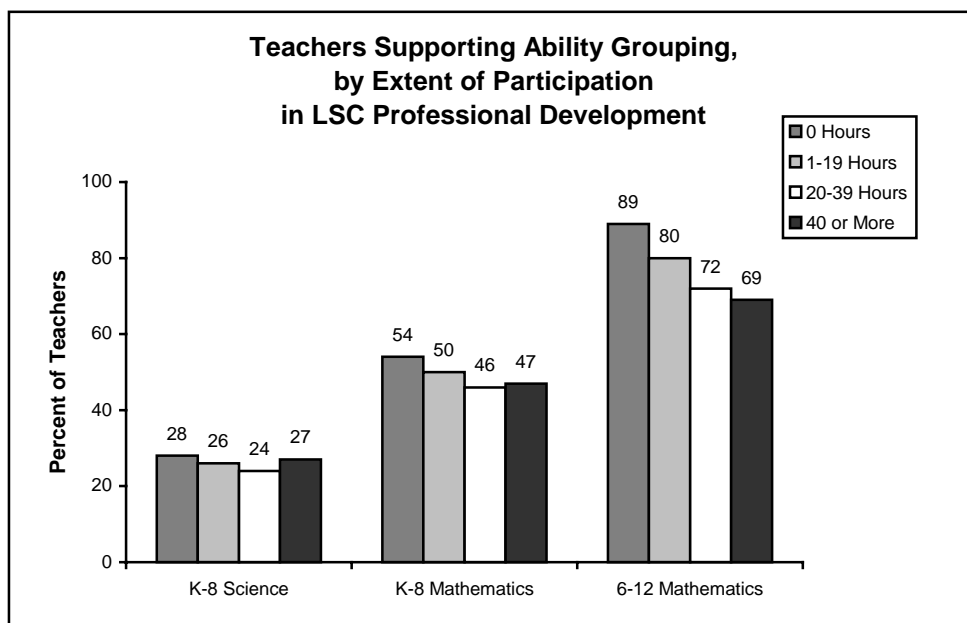


Figure 22

Results on a composite of several items related to teachers' attitudes toward standards-based teaching indicated a small, but significant difference for elementary science and elementary and secondary mathematics teachers, with the most highly-treated group having more reform-oriented attitudes than do untreated teachers.⁶ (See Figure 23.)

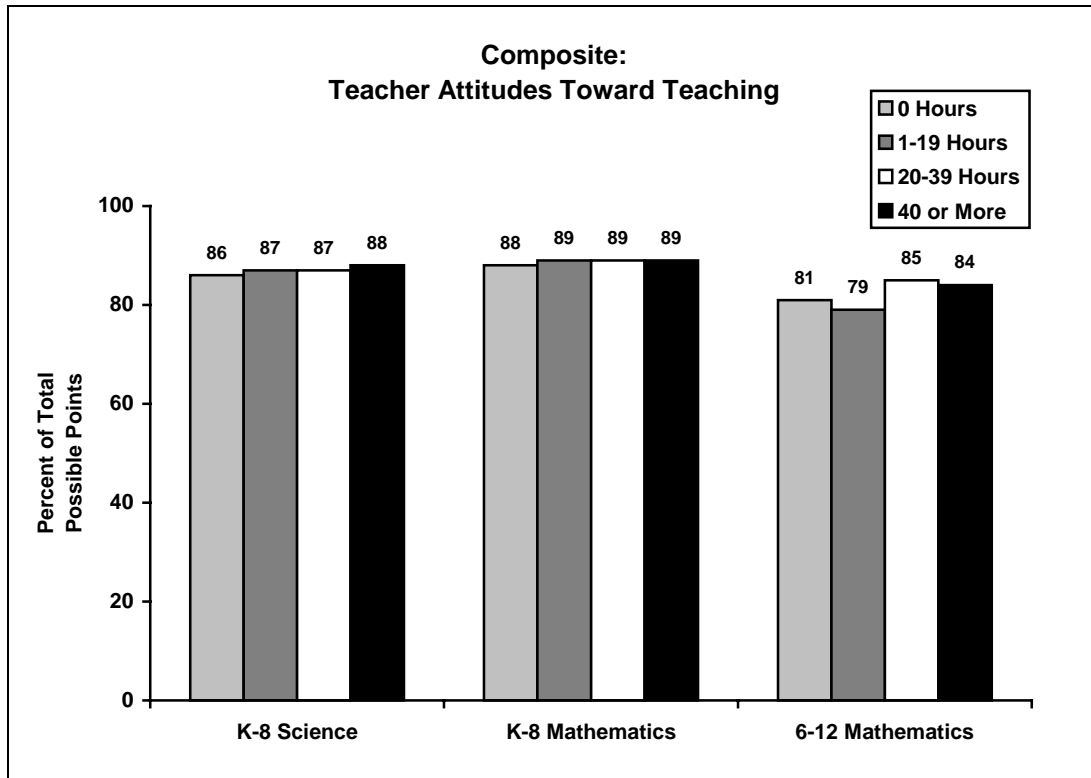


Figure 23

Participating in LSC professional development appears to have had a dramatic impact on elementary teachers' feelings of preparedness. As can be seen in Figure 24, 87 percent of K–8 science teachers who had participated in at least 40 hours of LSC professional development indicated they were at least fairly well prepared to teach science, compared to 64 percent of those who had not yet participated in LSC professional development.

⁶ See Data Analysis in Section I for a description of how composite scores were calculated. Results by treatment level are presented separately for K–8 science, K–8 mathematics, and 6–12 mathematics teachers. The effect size is calculated as the difference between the “0 hours” and “40 or more hours” group means, divided by the standard deviation of the population. Following standard conventions, effect sizes of 0.2 are considered small effects, 0.5 medium effects, and 0.8 large effects (Jacob Cohen, *Statistical Power Analysis for the Behavior Sciences*, Hillsdale, NJ: Lawrence Erlbaum Associates, 1988).

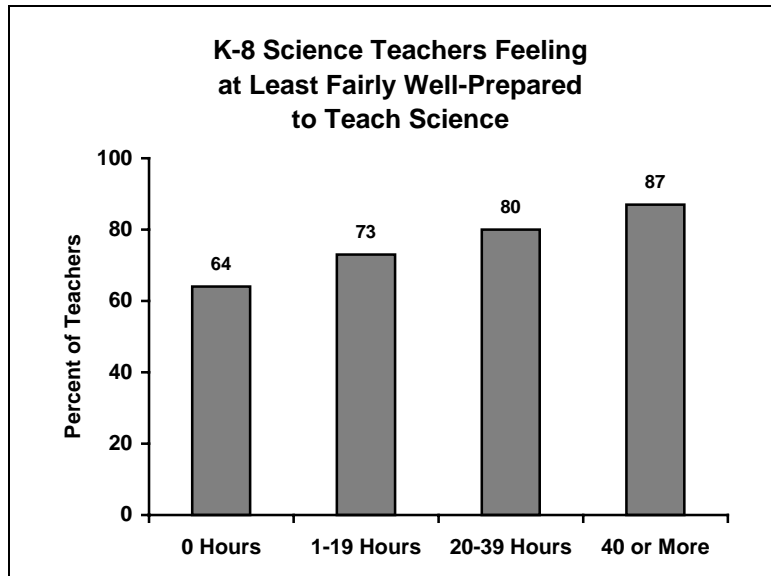


Figure 24

In mathematics, roughly 90 percent of K–8 teachers without LSC professional development indicated they were at least fairly well prepared to teach mathematics, so the comparison was made for very well prepared. As can be seen in Figure 25, 57 percent of K–8 mathematics teachers who had participated in at least 40 hours of LSC professional development indicated they were very well prepared to teach mathematics, compared to 42 percent of those who had not yet participated in LSC professional development.

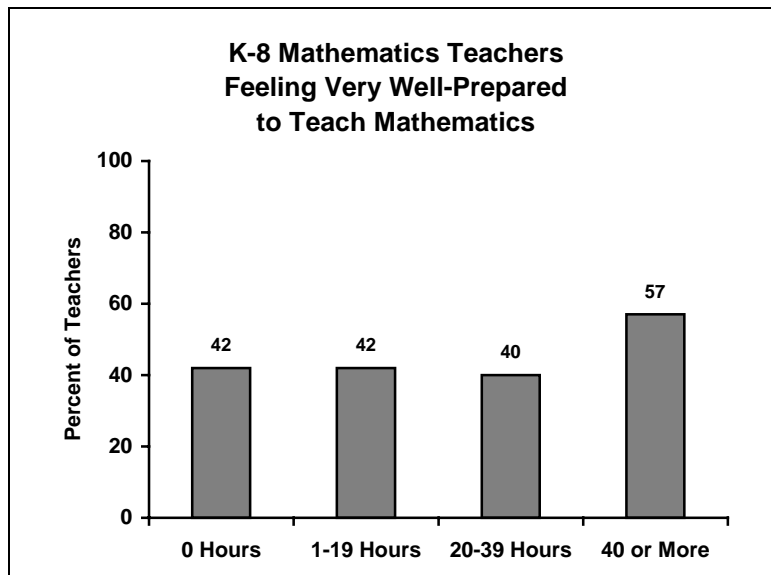


Figure 25

A similar pattern can be seen when teachers were asked about their preparedness to teach specific science and mathematics topics. In K–8 science, there were significant differences between untreated and highly-treated teachers on all the 11 topics listed, with effect sizes⁷ ranging from about 0.20 to about 0.40. (See Table 6.)

Table 6
K–8 Science Teachers Feeling at Least Fairly Well-Prepared
to Teach Each Topic, by Extent of Involvement in LSC

	Percent of Teachers				Effect Size
	0 Hours	1–19 Hours	29–39 Hours	40 or More	
The human body	65	71	76	75	.22
Ecology	50	56	61	65	.30
Rocks and soils	45	48	58	66	.43
Astronomy	42	43	47	53	.22
Forces and motion	38	42	43	53	.30
Sound	37	39	52	54	.34
Mixtures and solutions	36	38	42	54	.36
Electricity	34	36	40	49	.31
Machines	34	36	42	51	.35
Processes of change over time	30	37	34	42	.25
Engineering and design principles	20	22	20	28	.19

⁷ When comparing percents, the effect size is calculated using the difference between the arcsine transformation of the percents of the “0 Hours” and “40 or More Hours” groups. For composites, the effect size is calculated as the difference between the “0 Hours” and “40 or More Hours” group means, divided by the standard deviation of the population.

In K–8 mathematics, teachers with 40 or more hours of LSC professional development were significantly more likely than untreated teachers to indicate that they were at least fairly well-prepared to teach 10 of the 11 topics listed. The largest differences were in patterns and relationships and data collection and analysis, with effect sizes of 0.34 and 0.32, respectively. (See Table 7.)

Table 7
Mathematics Teachers Feeling at Least Fairly Well-Prepared
to Teach Each Topic, by Grade Range and Extent of Involvement in LSC

	Percent of Teachers									
	K–8 Mathematics					6–12 Mathematics				
	0 Hours	1–19 Hours	20–39 Hours	40 or More	Effect Size	0 Hours	1–19 Hours	20–39 Hours	40 or More	Effect Size
Computation	94	92	94	95	—	—	—	—	—	—
Patterns and relationships	87	92	94	96	.34	95	90	99	95	—
Numeration and number theory	87	86	89	92	.16	—	—	—	—	—
Estimation	86	87	89	92	.19	89	88	98	95	.23
Measurement	85	87	88	90	.15	95	88	96	95	—
Data collection and analysis	77	82	84	89	.32	79	74	92	88	.24
Geometry and spatial sense	76	78	84	85	.23	89	81	92	88	—
Pre-algebra	64	63	65	69	.11	97	94	90	93	—
Probability	62	61	67	75	.28	78	66	83	81	—
Technology in support of mathematics	53	58	54	62	.18	65	57	75	64	—
Algebra	51	50	52	59	.16	88	88	89	85	—
Functions and pre-calculus concepts	—	—	—	—	—	72	67	70	60	—
Statistics	—	—	—	—	—	57	41	59	51	—
Topics from discrete mathematics	—	—	—	—	—	31	32	39	30	—
Calculus	—	—	—	—	—	36	33	45	21	—
Mathematics structures	—	—	—	—	—	38	27	29	24	—

Participation in LSC professional development appears to have somewhat less of an impact on secondary mathematics teachers’ perceptions of their content preparedness, with only 2 of 14 topics, estimation and data collection and analysis, showing significant differences between untreated and highly-treated teachers. This may be partially explained by a “ceiling effect” due to high percentages of secondary mathematics teachers indicating they were at least fairly well-prepared to teach some content topics. Further, the low number of secondary mathematics teachers who were administered the questionnaire reduces the likelihood of finding significant differences.

When the various topic areas were combined into a single composite score, K–8 science teacher preparedness ratings ranged from 56 percent of total points possible for teachers with no treatment to 64 percent for those with 40 or more hours LSC professional development, a medium effect size (0.5 standard deviations). Similarly, the difference between 70 percent of total points possible with no treatment and 75 percent with 40 or more hours of K–8 mathematics treatment represents a small effect (0.3 standard deviations). Interestingly, the difference between 76 percent of total points possible with no treatment and 74 percent with 40 or more hours of 6–12 mathematics treatment represents a small negative effect (-0.2 standard deviations). (See Figures 26 and 27.)

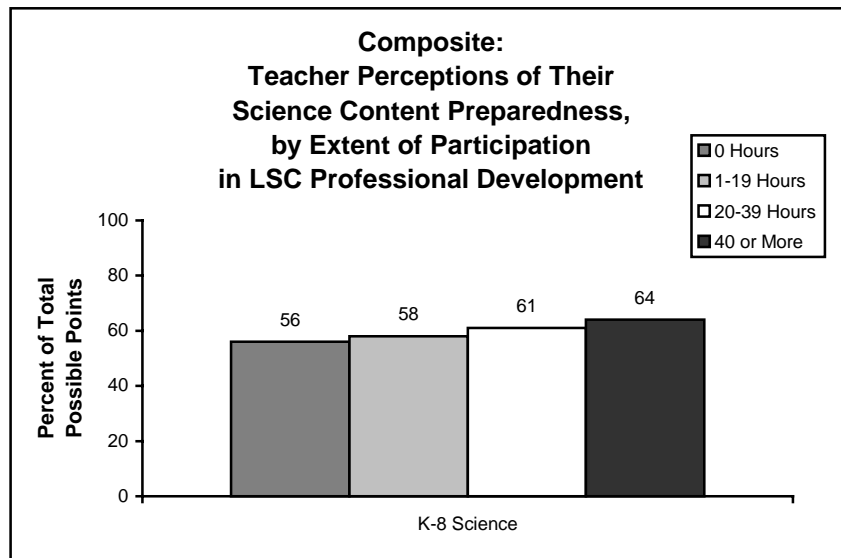


Figure 26

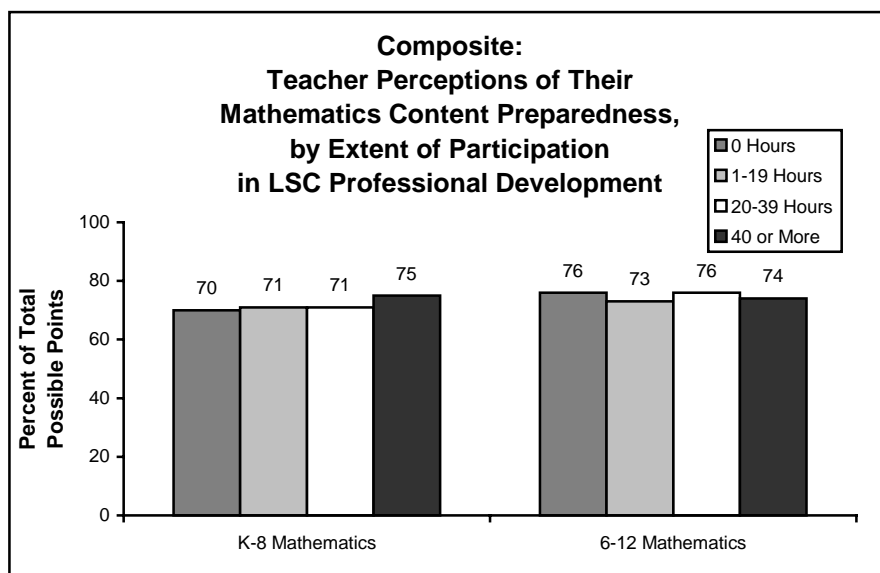


Figure 27

Questionnaire data on individual items provide additional support for the impact of the LSC on teacher self-confidence. For example, the larger the number of hours of LSC professional development, the more likely teachers were to indicate that they are well-informed about national mathematics/science standards. (See Figure 28.) Similarly, elementary teachers who had participated in 40 or more hours of LSC professional development were more likely than their untreated peers to indicate that they enjoy teaching mathematics/science. (See Figure 29.)

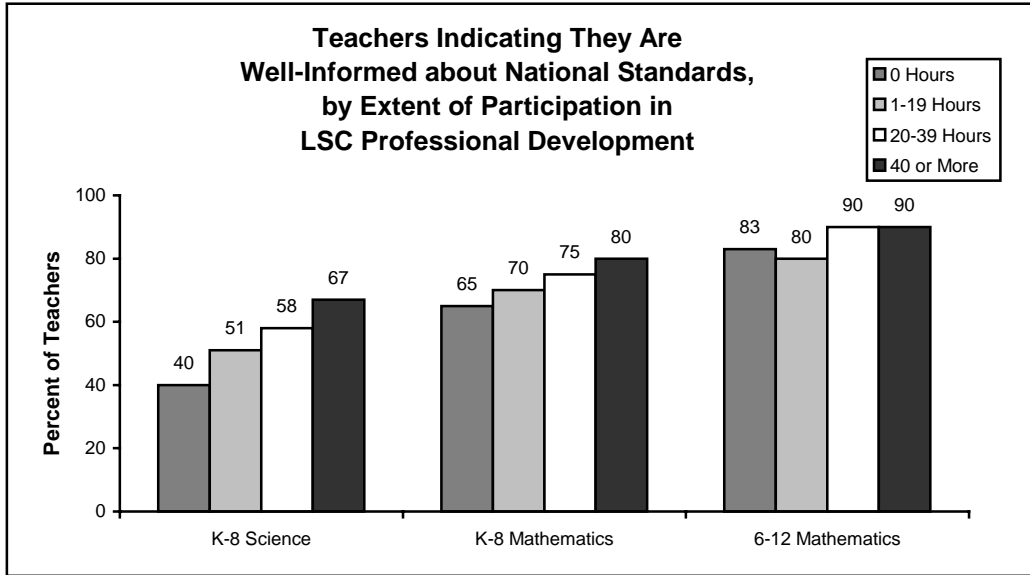


Figure 28

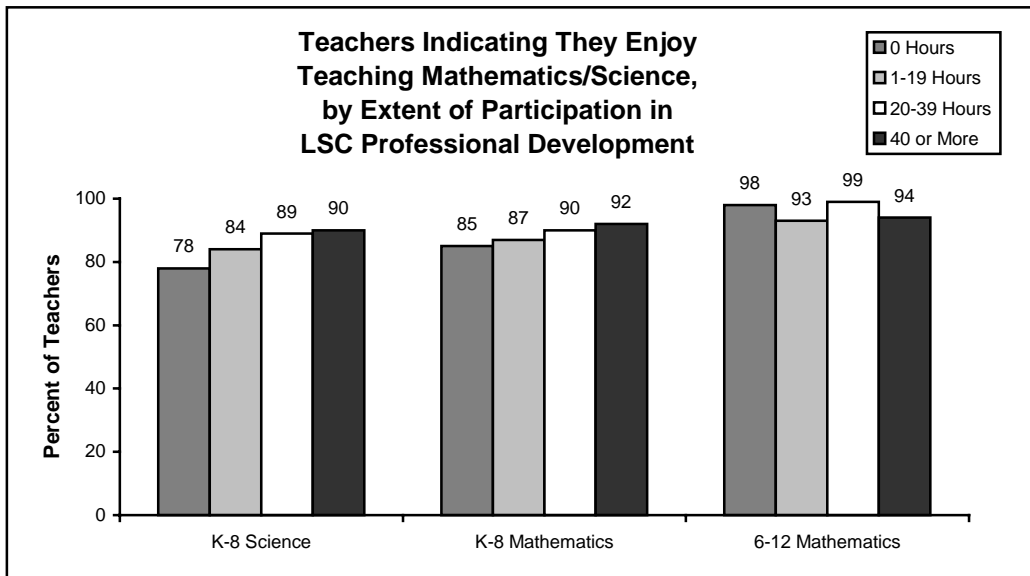


Figure 29

Figure 30 shows the results on a composite of items about teacher preparedness to use a variety of instructional strategies in their mathematics/science instruction, including taking students' prior understanding into account when planning curriculum and instruction, having students work in cooperative learning groups, and using informal questioning to assess student understanding. The nine percentage points difference between untreated and highly-treated K–8 science teachers constitutes a medium effect (0.6 standard deviations), the eight-point difference for K–8 mathematics teachers a small effect (0.4 standard deviations), and the three-point difference for 6–12 mathematics a small effect (0.2 standard deviations).

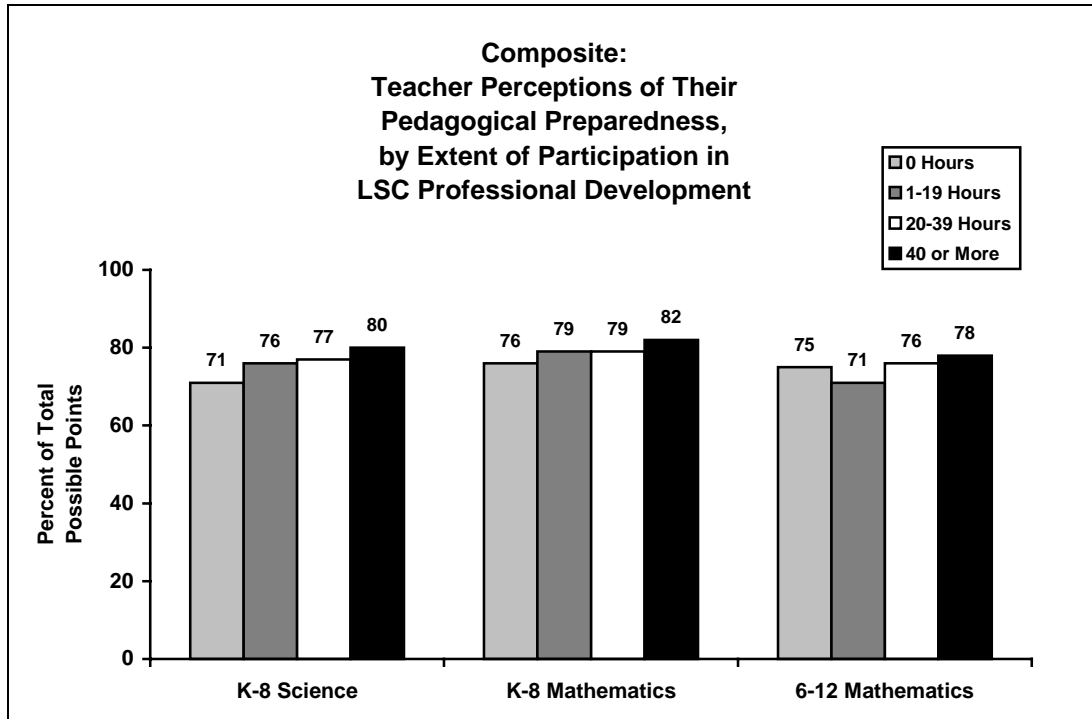


Figure 30

IV. Impact of the LSC on Classroom Practice

A. Introduction

The core evaluation focuses a great deal of attention on the impact of the LSC projects on classroom instruction. Data come from several sources: classroom observations, teacher interviews, and teacher questionnaires. In the following sections, the impact of the LSC on classroom practice is assessed by comparing results for teachers with varying extents of participation in LSC professional development.

B. Time Spent on Elementary Science Instruction

One of the major impacts of the LSC has been increased attention to science instruction in the elementary grades. As can be seen in Figure 31, the average number of days per week in which science is taught increased from 2.6 days among untreated teachers to 3 days among teachers with 40 or more hours of LSC professional development.

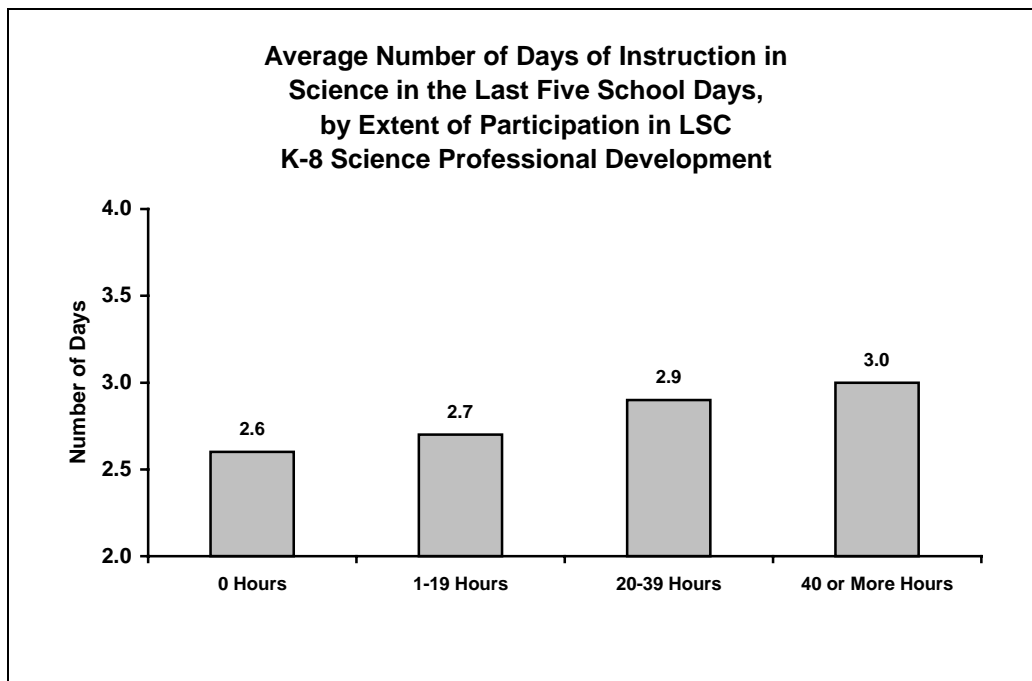


Figure 31

As would be expected, the increased frequency of science instruction resulted in a greater amount of time devoted to the subject. As can be seen in Figure 32, 32 percent of teachers who had participated in 40 or more hours of LSC science professional development spent 150 or more minutes on science each week, compared to only 20 percent of untreated teachers.

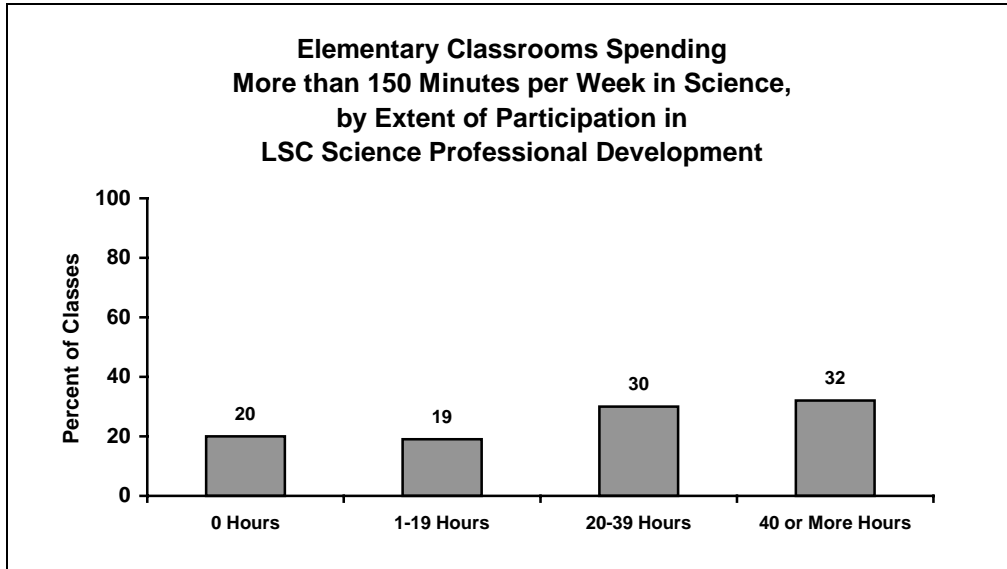


Figure 32

Interestingly, the number of science units taught per year does not appear to increase with participation in LSC professional development. (See Figure 33.) Rather, as can be seen in Figure 34, the length of units increases, with about half of the teachers who have participated most heavily in the LSC report spending more than four weeks on a typical science unit, compared to only 31 percent of untreated teachers.

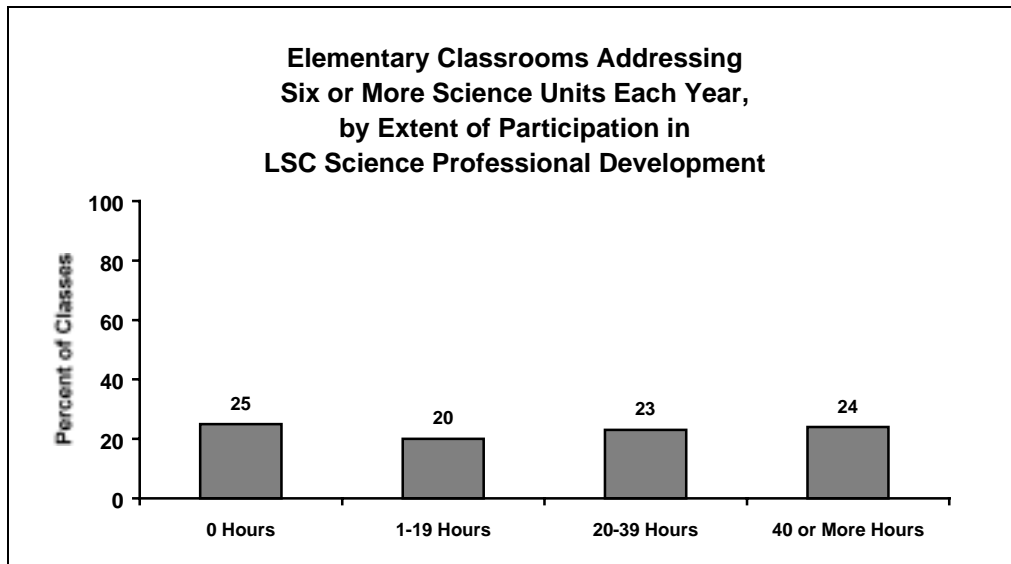


Figure 33

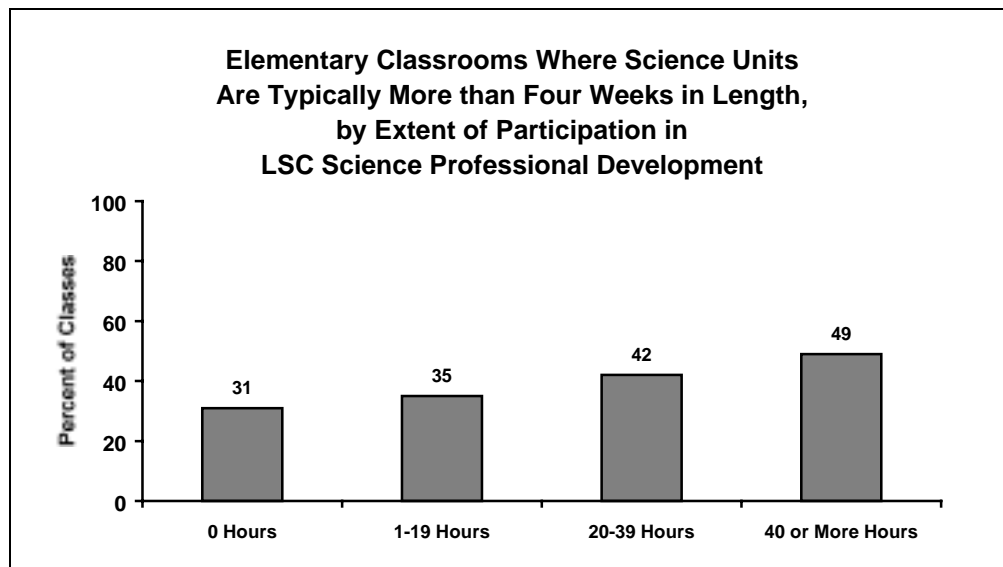


Figure 34

C. Instructional Strategies

One indication of the impact of LSC activities on classroom practice comes from composites created from questionnaire data. The investigative culture composite includes strategies used by teachers to facilitate exploration and investigation by students. It includes such practices as:

- Arranging seating to facilitate student discussion;
- Using open ended questions;
- Requiring students to supply evidence to support their claims; and
- Encouraging students to consider alternative explanations.

There is a significant increase in composite scores with increasing participation in LSC activities. (See Figure 35.) The eight-point difference between untreated and highly treated teachers in K–8 science, as well as the seven-point difference in K–8 mathematics, represent medium effect sizes (approximately one-half of a standard deviation in each case). The four-point difference in 6–12 mathematics represents a small effect size (0.3 standard deviations).

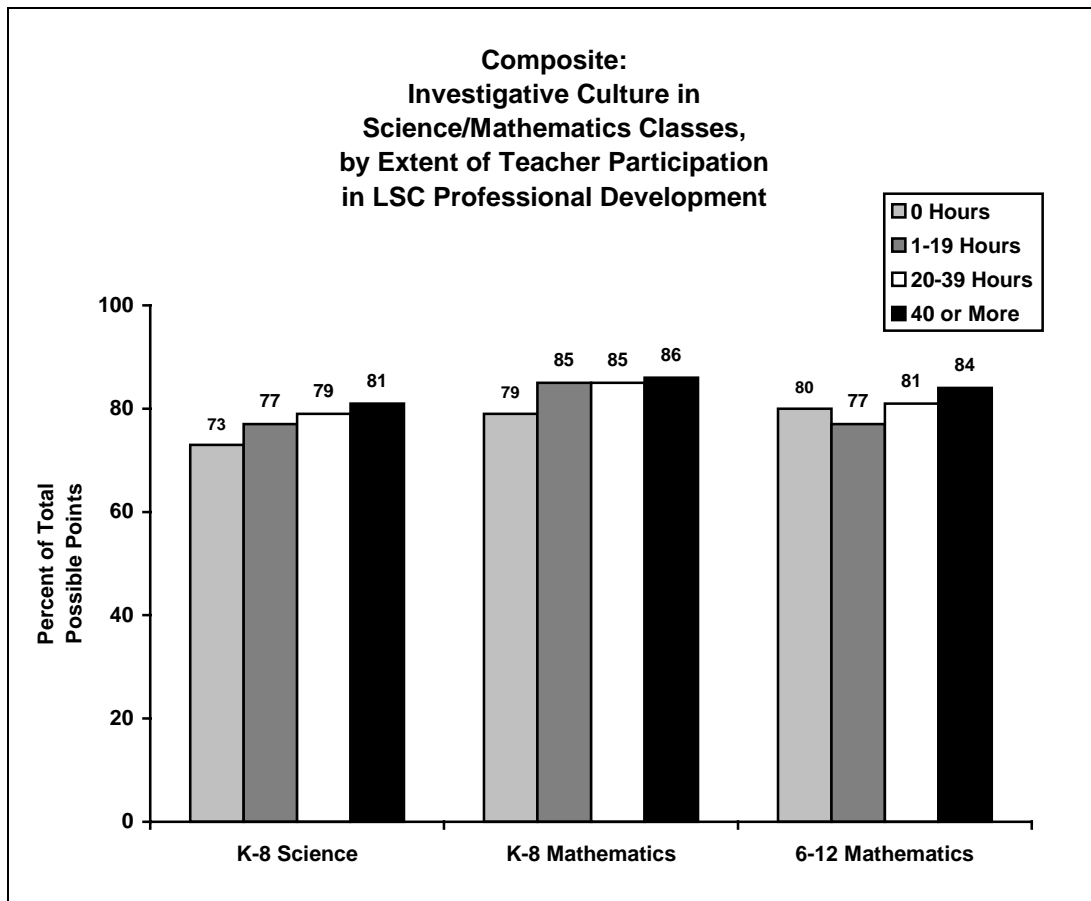


Figure 35

The investigative practices composite is tied to what students actually do in the classroom. It includes such instructional strategies as having students:

- Engage in hands-on mathematics/science activities;
- Work on models or simulations;
- Work on extended investigations; and
- Write reflections in a notebook or journal.

Again, as shown in Figure 36, there is an increase in composite scores across all subjects, with increasing participation in LSC activities. The seven-point difference in K–8 science between untreated and highly-treated teachers (0.5 standard deviations) represents a medium effect size, as does the nine-point difference in K–8 mathematics (0.6 standard deviations). The eight-point difference in 6–12 mathematics represents a small effect size (0.4 standard deviations).

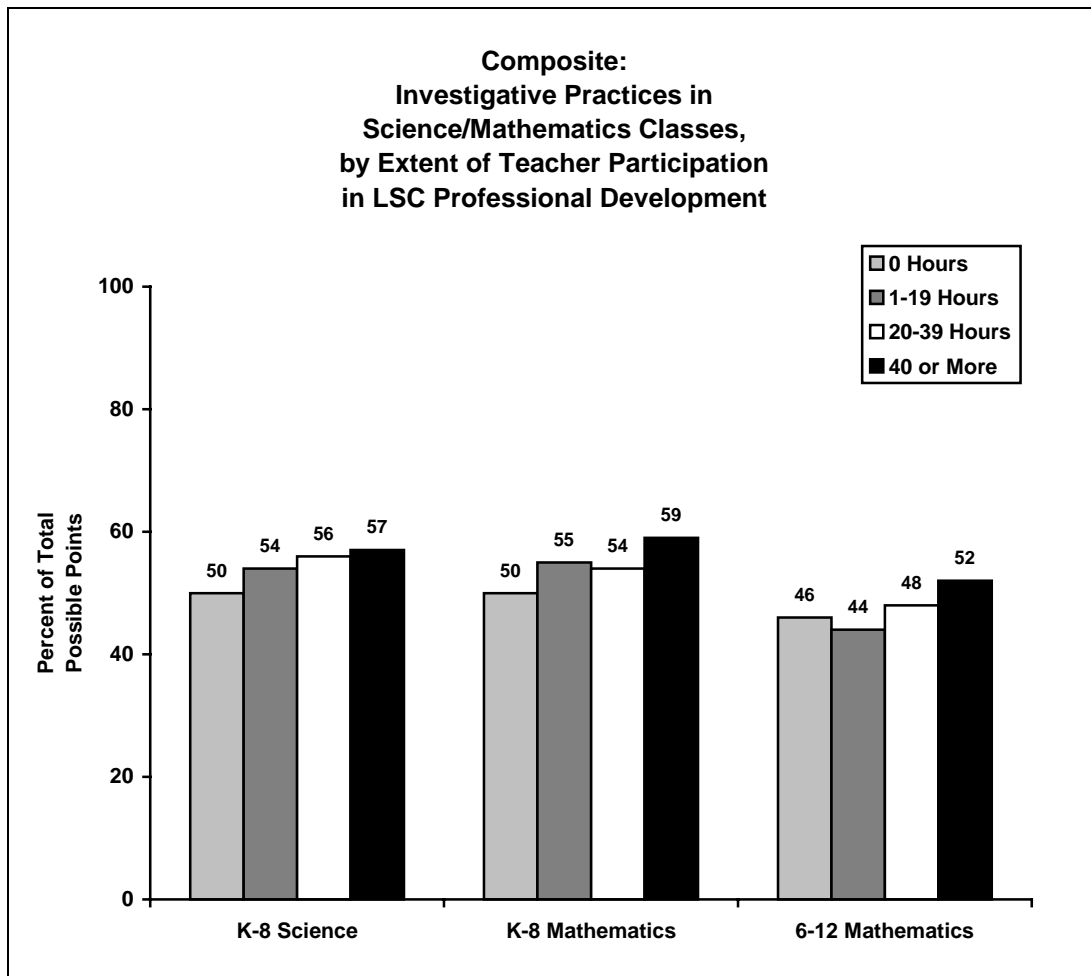


Figure 36

D. Quality of Observed Lessons

Trained observers visited classrooms of teachers who had already participated in LSC professional development and others who had not yet participated and assessed the quality of the lessons using a variety of indicators. (See box on next page.)

Observers then rated the quality of each lesson’s design and implementation, the science/mathematics content, and the classroom culture. In addition, each lesson received an overall capsule rating. As can be seen in Figure 37, lessons of “treated” teachers (those who had participated in 20 or more hours of LSC professional development) had considerably higher ratings in each area than those of teachers who had not yet participated.⁸

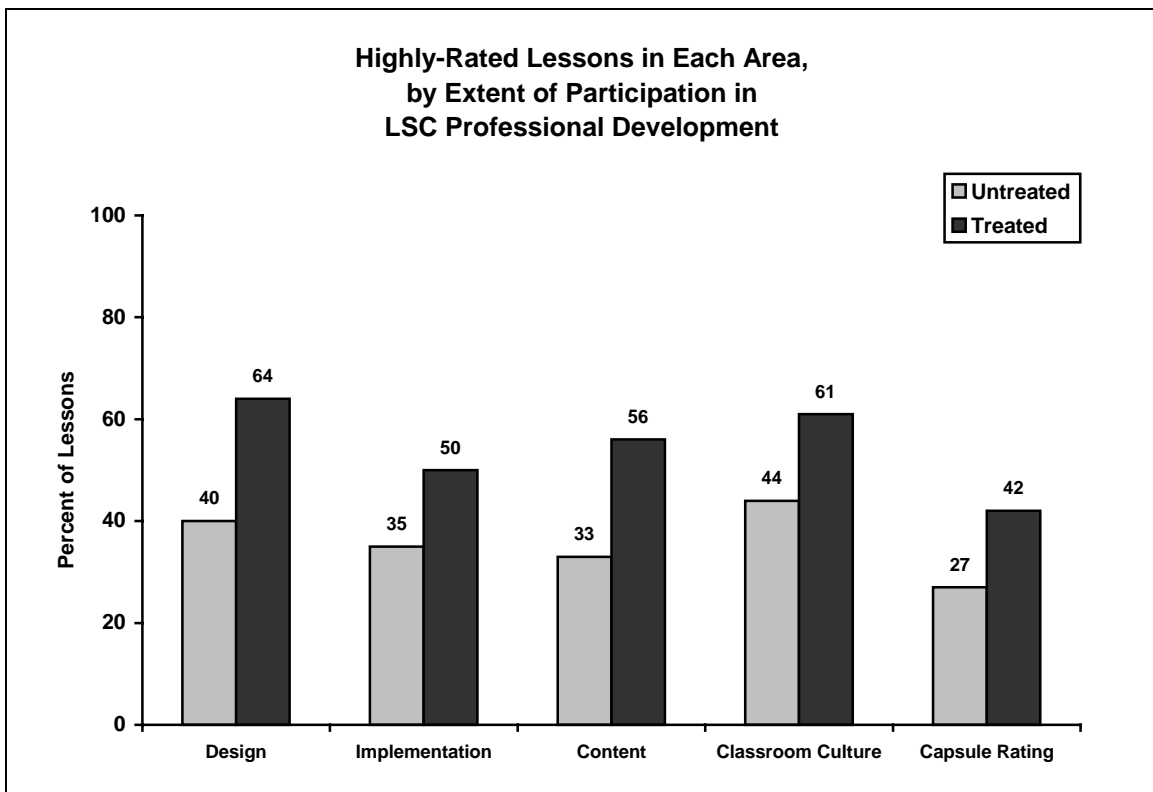


Figure 37

⁸ While questionnaire results were presented for four levels of participation in LSC professional development (0, 1–19, 20–39, and 40 or more hours), the considerably smaller number of classroom observations prevented that extent of disaggregation.

Sample Indicators for Classroom Observations

Design

- The design of the lesson incorporated tasks, roles, and interactions consistent with investigative mathematics/science.
- The design of the session reflected careful planning and organization.
- The instructional strategies and activities used in this lesson reflected attention to students' experience, preparedness, and/or learning styles.
- The resources available in this lesson contributed to accomplishing the purposes of the instruction.
- The design of the lesson encouraged a collaborative approach to learning.
- Adequate time and structure were provided for "sense-making."
- Adequate time and structure were provided for wrap-up.

Implementation

- The instruction was consistent with the underlying approach of the instructional materials designated for use by the LSC.
- The teacher's classroom management style/strategies enhanced the quality of the lesson.
- The pace of the lesson was appropriate for the developmental levels/needs of the students and the purposes of the lesson.
- The teacher took into account prior knowledge of students.
- The teacher's questioning strategies were likely to enhance the development of student conceptual understanding/problem solving (e.g., emphasized higher order questions, appropriately used "wait time," identified prior conceptions and misconceptions).

Mathematics/Science Content

- The mathematics/science content was significant and worthwhile.
- The mathematics/science content was appropriate for the developmental levels of the students in this class.
- The students were intellectually engaged with important ideas relevant to the focus of the lesson.
- Teacher-provided content information was accurate.
- Appropriate connections were made to other areas of mathematics/science, to other disciplines, and/or to real-world contexts.

Classroom Culture

- Active participation of all was encouraged and valued.
- There was a climate of respect for students' ideas, questions, and contributions.
- The interactions reflected collegial working relationships among students (e.g., students worked together, talked with each other about the lesson).
- The climate of the lesson encouraged students to generate ideas, questions, conjectures, and/or propositions.

Classroom observers also considered the potential for student impact as they observed lessons being taught. Areas of likely student impact are compared for treated and untreated teachers in Figure 38. In each case, lessons taught by teachers who had participated in 20 or more hours of LSC professional development were judged to be more likely than others to have a positive impact on students.

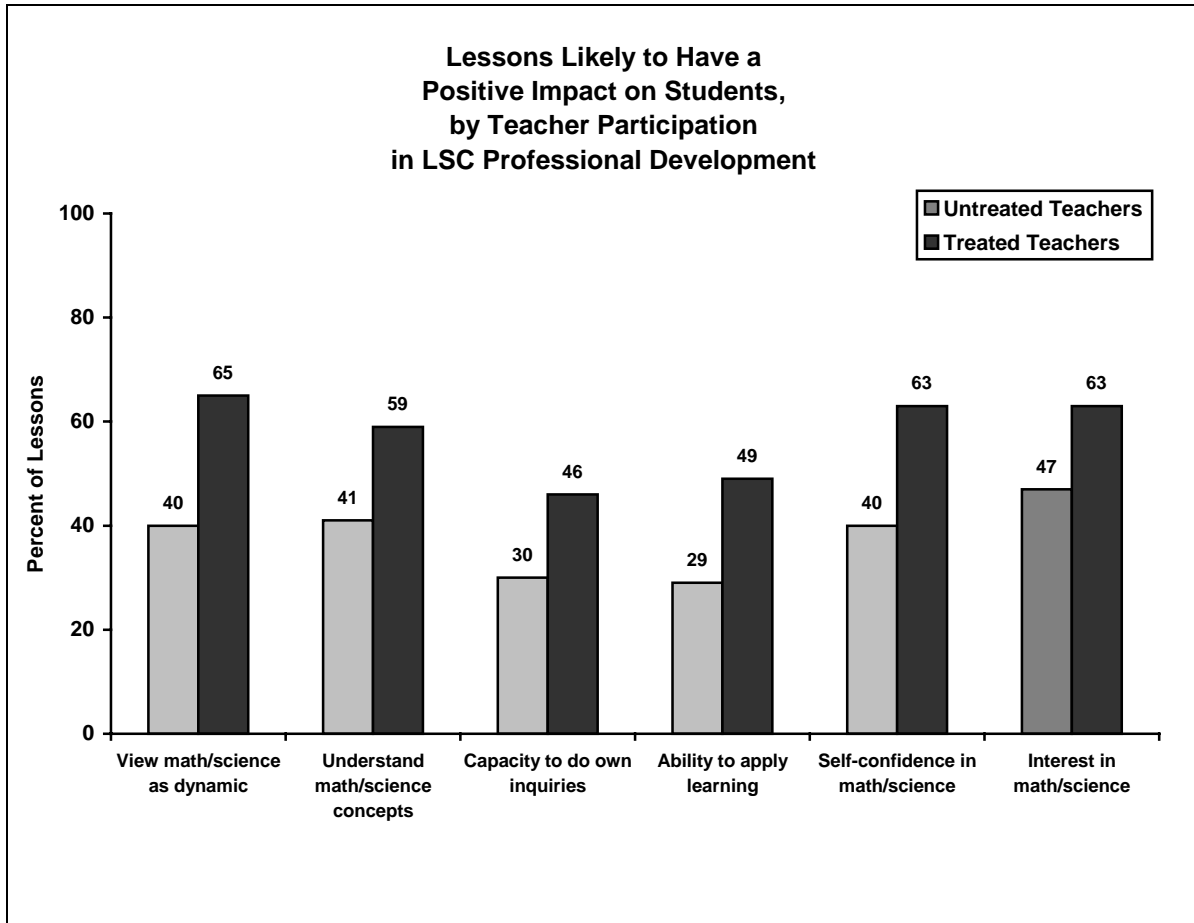


Figure 38

Since a specific goal of the LSC program is to increase the use of exemplary instructional materials, classroom observers were asked to note whether or not these materials were being used and to comment on the quality of their use. As can be seen in Figure 39, 60 percent of the treated teachers were observed using the designated instructional materials, compared to 32 percent of the untreated teachers.

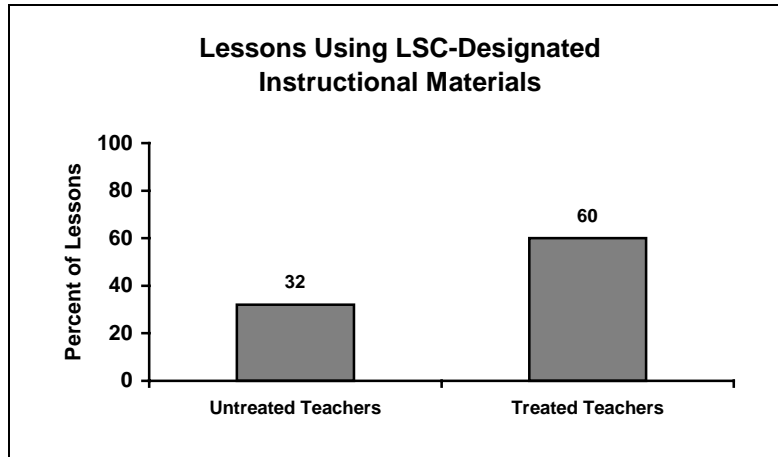


Figure 39

It appears that the combination of LSC-designated materials and LSC professional development is having a positive impact on the quality of classroom instruction. Only 21 percent of lessons taught by teachers who had not participated in LSC professional development and were not using the designated materials received high ratings. Lessons taught by teachers who had participated extensively in LSC professional development *and* were using the designated materials were more than twice as likely to receive high ratings. (See Figure 40.)

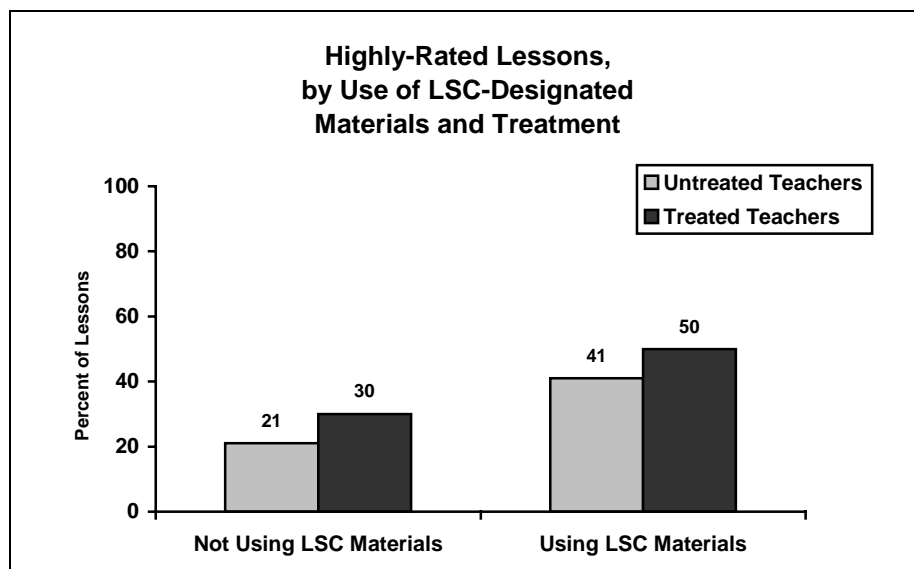


Figure 40

Other findings from the core evaluation also reinforce the LSC program’s emphasis on having teachers implement the designated instructional materials as designed by their developers. Figure 41 shows that the more closely the lesson adhered to the instructions provided in the teacher’s manual, the more likely it was to be rated effective. Sixty-one percent of lessons that adhered closely to the materials were given high ratings (capsule ratings of 4 or 5) compared to only 19 percent of the lessons with low adherence.

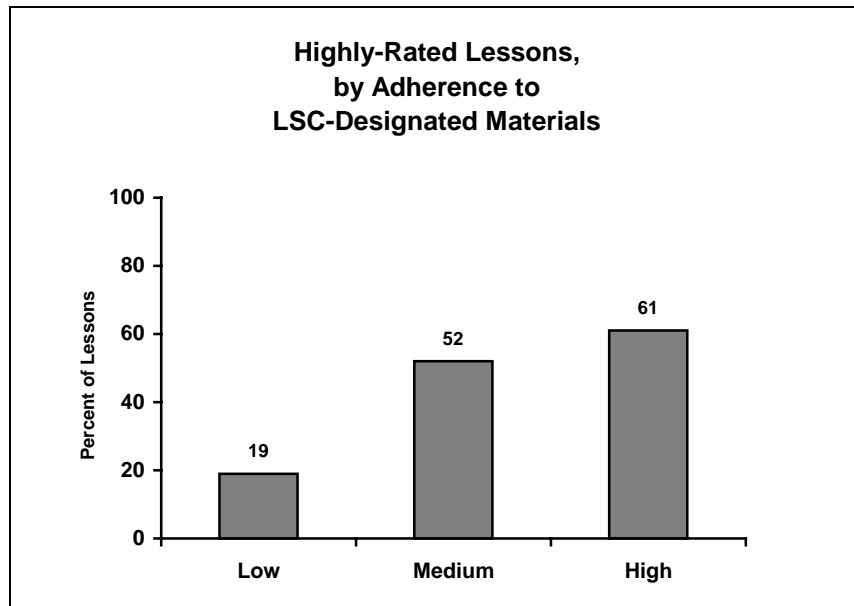


Figure 41

V. Conclusions

Results from the 1999–2000 Local Systemic Change core evaluation continue to show areas of strength and weakness in the design and implementation of the professional development and the impact of those interventions on teachers and their teaching.

Evaluators were asked to observe a representative sample of professional development sessions and rate each in relation to its particular purposes. Sessions were most likely to receive high ratings for their choice of appropriate content and instructional strategies, the facilitators' understanding of mathematics/science concepts, the climate of respect for participants, and the fact that active participation was encouraged. The most salient weaknesses in sessions for classroom teachers were in modeling effective assessment strategies, and questioning participants in ways likely to enhance their conceptual understanding.

Interestingly, the majority of the observed sessions were facilitated by district personnel, most often full or part-time teacher leaders. Slightly fewer than 1 in 5 sessions included scientists or mathematicians as professional development providers, and only 2 in 5 had a major focus on increasing teacher content knowledge, raising the concern that the LSC professional development does not emphasize adequately the need to deepen teacher disciplinary content knowledge. Similarly, only 30 percent of observed sessions included helping teachers understand student thinking/learning about mathematics or science content, an area that is increasingly being identified as important in teacher development.

While only 40 percent of teachers rated the LSC professional development excellent or very good, the more hours of participation in LSC professional development, the higher the ratings of quality. In interviews, teachers indicated that networking with other teachers, having the opportunity to deepen their content and pedagogical knowledge, the high quality of LSC professional development and the opportunities to collaborate with other teachers were particularly helpful aspects of the LSC. Concerns focused on the amount of time required to attend professional development; in some cases, the quality of the professional development; and especially, problems teachers experiences in implementing the instructional materials in their classrooms.

Questionnaire data collected from targeted teachers indicated that LSC professional development has had a significant impact on teachers' attitudes and beliefs about mathematics/science education. For example, treated teachers were less likely to advocate ability grouping and more likely to support reform-oriented teaching practices than their untreated peers. In addition, participants were becoming more confident in their knowledge of mathematics and science content, and more likely to use standards-based instructional strategies.

Both mathematics and science participants were making greater use of strategies that facilitate exploration and investigation by students, such as using open ended questions and requiring students to supply evidence to support their claims. Participants were also more likely to use reform-oriented teaching practices such as having students engage in hands-on activities, work on extended investigations, and write reflections in notebooks or journals.

Classroom observations show that teachers who participated in LSC professional development were more likely to be using the designated materials, and that the quality of the lessons taught improved with increased participation in LSC activities. Furthermore, lessons taught by teachers who had participated extensively in LSC professional development and were using the designated materials were most likely to receive high ratings for their lessons, lending support to the program's focus on professional development aimed at implementing exemplary instructional materials.

Appendix Table

Summary of the Impact of LSC Professional Development on Teacher Perceptions of Their Preparedness and Teaching

Questionnaire Composite	Effect Size					
	K-8 Science		K-8 Mathematics		6-12 Mathematics	
	Number of Standard Deviations*	Effect Size**	Number of Standard Deviations*	Effect Size**	Number of Standard Deviations*	Effect Size**
Attitudes Toward Teaching	.25	+	.20	+	.29	+
Pedagogical Preparedness	.61	++	.43	+	.21	+
Content Preparedness	.48	++	.31	+	-.16	-
Investigative Culture	.53	++	.54	++	.28	+
Investigative Practices	.53	++	.60	++	.40	+
Use of Calculators and Computers	—	—	.32	+	.32	+

* Comparison between untreated teachers and teachers with 40 or more hours LSC professional development.

** A single “+” indicates a small positive effect; a double “++” indicates a medium positive effect..

Report Available on the Web

This report is available on Horizon Research, Inc.'s web site:

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