# *SEATTLE PARTNERSHIP FOR INQUIRY-BASED SCIENCE:*

## A LOCAL SYSTEMIC CHANGE INITIATIVE

## End-of-Project Report

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**May 2002**

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## Background

The *Seattle Partnership for Inquiry-Based Science* is a district-based Local Systemic Change (LSC) project, funded six years ago by the National Science Foundation with the specific aim of implementing a high quality science program in *all* elementary classrooms in the Seattle Public Schools. The intended goal was to create a steady, rich diet of science teaching and learning in each elementary school. From the outset, a specific theory of action guided the initiative. The theory was to first adopt a well-designed elementary science curriculum based on the NRC's National Science Education Standards — namely, a series of kit-based units for each grade level — and to provide extensive professional development for all teachers — approximately 100 hours per teacher over 5 years that would support the implementation of this new curriculum. In addition, other elements of systemic infrastructure — such as community partnerships, parent events, and a materials center for the maintenance and distribution of the science kits — were to be put in place to strengthen and institutionalize the project's efforts. The Local Systemic Change grant also included funding for a Program Manager and a team of 5-7 full-time Science Curriculum Consultants (SCCs) to provide instructional leadership in support of science improvement on a variety of levels —facilitating professional development sessions, serving as coaches and mentors in the classroom setting, and working with principals. Over the years, the SCCs also worked to establish more leadership for science at the building level by cultivating a cadre of Lead Teachers, who also serve as providers of LSC professional development.

Prior to adopting the curricular materials designated for their Local Systemic Change initiative, the Seattle Public Schools had gone nearly a decade with very little attention paid to science education, particularly in grades K-5. The elementary science textbooks from the previous adoption were outdated. Centralized district science expertise was lacking without any designated leadership position for science. In the spring of 1997, when Inverness Research Associates came on board as the external evaluators for the Seattle Elementary LSC, many teachers told us that science was simply not a high priority for the district. Seattle, like many of its large, urban counterparts, was facing more pressing issues in the areas of language, literacy, and mathematics. Science was considered more of an extra than a core subject area for the elementary grades. At the time, it was also unclear whether the newly mandated state assessment – the "WASL" – would include science and this contributed to its relatively low ranking among the district's priorities. Five years later the situation is significantly different, largely as a result of the work done with the support of the NSF-funded LSC.

The Seattle Public Schools is a metro district that serves approximately 22,500 elementary students from a wide range of ethnic and socio-economic backgrounds. At this time, there are 71 elementary schools, employing approximately 1000 teachers in grades K - 5. Three characteristics largely define this district. First, it is site-based managed, meaning that schools have considerable autonomy in designing their instructional programs and the central office does not mandate curriculum. Second, Seattle is a "choice district," meaning that elementary children and families can choose their schools; in turn, schools feel some pressure to compete for students and the education dollars attached to them. Third, the district has recently implemented a standards-based learning system that includes a strong accountability component. In short, there is strong pressure on schools, teachers, and students to perform across all academic areas — and reform efforts abound. At the elementary level, teachers have told us about reform projects in math, social studies, and literacy that have all taken place in the past five years. Local foundations also play a role. For example, the Gates foundation currently contributes millions of dollars for schools to develop and implement transformation plans to improve student achievement; and the Stuart Foundation has funded numerous programs in the recent past. Overall, Seattle is a district that is fully engaged in multiple reform efforts — and all must compete for time and attention. So while the LSC has served as a major improvement effort in Seattle, it is clearly not the only effort.

Within Seattle's reform-minded context, the strong local partnerships that laid the foundation for the Seattle Elementary Science LSC in the mid-1990's have continued to set this project apart from other reform efforts in the Seattle Public Schools. The original grant stemmed from a relationship between the district and the University of Washington's Department of Molecular Biotechnology, under the direction of Dr. Leroy Hood. Prior to receiving funding, the project established a Leadership Team comprised of district personnel, university faculty, and local business partners, such as Boeing. The Leadership Team meets to this day, albeit with changes in membership. Over the years, the project's relationship with the University of Washington evolved to include other departments and faculty members. For example, Dr. Lillian McDermott and the "Physics Education Group" became pivotal partners and central providers of science content training for project teachers and Science Curriculum Consultants alike. Other local organizations, such as the Seattle Aquarium, also sought a role. The chart below lists the current partnerships that support the elementary science LSC effort.

**CURRENT PARTNERSHIPS SUPPORTING THE SEATTLE ELEMENTARY SCIENCE LSC**

| Partner | Role |
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| Alliance for Education<br>*(a foundation supporting the Seattle Public Schools)* | • works closely with top leadership<br>• last year, formed a Science Compact with leadership from executives from Immunex, Boeing, the Alliance, and Central Office administrators<br>• $350,000 for fieldtrips over 5 years |
| Boeing | • works with Alliance for Education<br>• served on Leadership Team earlier in the project<br>• $80,000 for scientist stipends |
| City of Seattle | • helps project connect with parks for fieldtrips<br>• provides teacher stipends for Initial Use courses<br>• provides books to accompany "Land and Water" unit<br>• provides microscopes for "Microworlds" kit |

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| Fred Hutchinson Cancer Research Center | • has had a volunteer scientist<br>• has had scientist on the Leadership Team for about 3+ years<br>• donated furniture |
| Institute for Systems Biology | • provides countless hours of leadership, time & help<br>• provided funding for the first four Annual retreats and the science content debriefs<br>•provided $20,000 for non-fiction books – Hood Family Foundation<br>• supports the Family Science program, an important component of the LSC program |
| UW – Dept. of Molecular Biotechnology | • original key partner but diminished with founding of the Institute for Systems Biology |
| UW – Dept. of Biostatistics and Division of Medical Genetics | • complete designing and teaching of the 24-hour Data Analysis course (all hours donated by accomplished statistician researcher) |
| UW – Dept. of Physics – Physics Education Group | • helps with the design and facilitation of science content courses<br>• recruits scientists, including many from their own department<br>• developed a special course for training scientists how to work with teachers<br>• provided SCCs with science content support (200 hours for most |
| UW K-12 Science and Math Institute | • helps recruit and organize scientists to teach and/or co-facilitate science content courses |
| Head Start Program | • works with the LSC to offer the district's youngest underserved children exposure to science and an edge on what lies ahead |
| Thornton Creek Project | • provides scientist to co-facilitate content training for the "Land and Water" unit<br>• designated scientists take on additional roles: organizing class excursions to watersheds for field trips, visiting classrooms to share information with students, works with the city and LSC to develop new support strategies for this unit<br>• is working to create a class and a field trip to be an extension of the "Microworlds" kit |
| Seattle Aquarium | • provides scientist expertise for "Ecosystems" unit<br>• support materials for "Ecosystems" unit<br>• provides initial use and science content courses for teachers for the next three years |

For more than six years, this collection of organizations and individuals, both inside and outside the Seattle Public Schools, has worked to put the LSC reform effort in place and to ensure that it might have a future beyond the NSF funding period.

## This Report

As the five-year grant reaches its endpoint, Inverness Research Associates is in the midst of concluding its work with the *Seattle Partnership for Inquiry-Based Science*. Therefore, in response to a specific request from the project, we have drafted this summary report. This report aims to document the present state of the project, focusing in particular on what has been accomplished during the grant's timeframe. We feel it is important to note that this report is <u>not</u> intended to provide the reader with a detailed, comprehensive summative evaluation. Rather it is

meant to help the reader understand the current status of elementary science teaching in Seattle and to portray the accomplishments to date of the LSC project as it continues to work towards the goal of providing high-quality science learning experiences for every elementary student in the city of Seattle. The report is organized around a collection of "cornerstone claims" and supporting evidence – a set of findings that we believe together make the case for the benefits yielded to date by the work of the LSC project.

Our purpose is to give the outside reader a real sense of where the LSC is at this point in time and what progress has been made in getting to this point. We are *not* going to critically examine all of the challenges that this project has faced over the course of its work. Nor do we provide a detailed account of the initiative's year-by-year progress. Rather, we stand back and take a snapshot of the present state of elementary science education in Seattle, and compare it to what elementary science education looked like in Seattle 5 or 6 years ago. As such, this report offers the reader a pre-LSC/post-LSC look at elementary science education in the Seattle Public Schools, interpreted through the eyes of the external evaluation team that has monitored the work of this project for a number of years.

While the Seattle Elementary Science LSC has gone a long way toward introducing inquiry-based science into grades K-5 of the Seattle Public Schools, it is not yet perfect. As with any systemic project at this stage, issues of quality and consistency continue to surface. Still, this project has undeniably made significant contributions to the district-wide teaching of elementary science. There is no doubt that without the focus and funding that accompanied the LSC effort, nowhere near as much science would have been taught; nowhere near as many teachers would have participated in so many hours of science-based professional development; and nowhere near as many students would have been exposed to the kinds of high-quality, hands-on science lessons they are experiencing now.

## Cornerstone Claims

The ten cornerstone claims that follow are based directly on the work of the Seattle Elementary Science LSC and the degree to which different components of the ongoing reform effort are now in place. They delineate what we see as the major indicators of the health of elementary science education in Seattle, the major changes that have occurred, and the major contributions of this particular project. Taken together, they provide a sense of the infrastructure that has been created in Seattle to support improvement in science education over the course of the LSC.

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| **CLAIM #1:** | **The Seattle Public Schools has articulated and set clear expectations for what elementary students should know and be able to do in the area of science. Its science program provides the necessary instructional materials and professional resources to support teachers in meeting these expectations.** |

During the 1999-2000 academic year, the Seattle Public Schools first published its district science standards. At the time, carefully selected science kits had already been made available to elementary teachers for more than three years. In authoring the standards, district leaders turned

to the local expertise of their LSC staff. Both the LSC Program Manager and the SCCs worked closely with members of the science standards committee to ensure that the new district standards were in keeping with existing state and national standards for elementary science. They recognized that doing so would also ensure alignment with the kit-based curriculum designated by the LSC.

In support of the Seattle's science standards effort, the SCCs also developed 18 alignment documents and 18 conceptual stories – one pair for each of the 18 units that the district had adopted. The alignment documents are designed to help teachers see how each lesson contributes to meeting the district and state science standards or EALRs – "Essential Academic Learning Requirements." Conceptual stories also clarify how sub-concepts within a particular kit lead to the development of larger concepts, not only for the kit itself but also for the particular grade band. During this period of standards articulation, LSC staff also recommended changing four of the designated science kits, two at the 5th grade level and two at the Kindergarten level. The district accepted this advice and turned to the science program to provide the support teachers would need to implement the new kits.

In short, what we see over the past six years is a strategy whereby the Seattle Public Schools has sequentially committed itself to standards-based goals in science education and to kit-based science as a means of meeting those goals. A complete instructional program for elementary science is now in place – one that includes three kits for each grade level, requisite science content training, professional support for the teaching of each kit-based unit, and materials resources. This program is made available to all teachers in all schools and therefore, to all children. The district strongly endorses the science program, but keeping to its spirit of site-based decisionmaking will not mandate it – meaning that participation on the part of teachers and schools remains voluntary.

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| **CLAIM #2:** | **The LSC program has developed and the district has further invested in a system of materials refurbishment and distribution that represents a strong and essential piece of the infrastructure for providing quality elementary science education in the Seattle Public Schools.** |

At the present time, almost 1000 teachers and *all* 71 elementary schools in the Seattle Public Schools are served by the Materials Center that was first established as part of the LSC effort six year ago. With 3 science units per grade between September and May, this equates to almost 300 school visits each year simply for the purposes of dropping off and picking up kits. Over the course of the grant, the location of the Materials Center has changed two times, but the staff has remained remarkably consistent. In addition to a full-time Materials Manager, there is one full-time assistant, one part-time assistant, 3-7 "light duty" workers from the district's Risk Management department, and a small team of highly committed volunteers. Together, they have created a highly efficient system of delivering, retrieving, and refurbishing kits. This system involves a carefully devised schedule that allows for kits to rotate at each grade level, which maximizes the number of kits in classrooms and minimizes the number of kits sitting fallow on warehouse shelves.

The Materials Center staff also has a reputation for being particularly resourceful and highly responsive to the needs of teachers. Overtime, teachers have shared with us many stories of their science lessons being saved by a last-minute delivery of supplies or "critters". In the early years, the Materials Center staff researched and designed many of their own replacement materials when products from the kit suppliers failed as a result of regular classroom use. They have even learned to raise many of their own plants and organisms for the life science units when needed. More recently, the Materials Center has expanded beyond the Seattle Public Schools to provide regional service to a small group of Washington districts that were interested in modeling their science improvement efforts on the Seattle Elementary Science LSC. While these state partners tend to be more rural, they include two Native American tribal schools and one urban private school targeting African American children.

For the sake of clarity, according to what we hear from teachers and what we see in their classrooms, it is the centralized, district-supported Materials Center that makes possible the reality of trying to teach 3 kit-based science units in every classroom every year. In our annual interviews, teachers have told us repeatedly how much they appreciate and have come to rely on the timely arrival of each kit as a physical reminder that they need to make time for science. Teachers also recognize that it would be impossible for individual schools to provide this level of service on their own.

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| **CLAIM #3:** | **The LSC grant has enabled the district to put into place a science leadership team as that can help the district understand the realities of science teaching at the elementary level and inform district decision makers about what is needed to maintain the course of improvement.** |

As with the Materials Center, continuity of staff within the project's instructional leadership team has played a significant role in helping this LSC stay a course of steady improvement. The current Project Manager, a "hands-on" leader and a determined advocate for elementary science, was hired at the beginning of the third year of the grant. Prior to taking on this role, she was an elementary principal in Seattle and the sole school-level administrator on the LSC's Leadership Team. She has a thorough understanding of the many issues that come into play when trying to implement an inquiry-based science program in the elementary grades and has worked continuously to expand the project's circle of partnerships both inside and outside the district. One of her primary responsibilities has been coordinating and mentoring the SCC group.

Of the 5 SCCs that are currently active in the science program, one SCC has worked with the project since the very beginning, two came on board during the second year, and two joined the group the following year. As a result, each SCC can boast not only 3 or more years of direct experience with the LSC, but also more than 400 hours of professional development and leadership training — all in the service of promoting high-quality elementary science instruction in the Seattle Public Schools. All of the SCCs also came directly from elementary teaching positions to the science project—meaning that prior to serving as a SCC, they were teaching the kits themselves. As a result, their expertise is strongly grounded in real and relevant classroom experience. The end result is a carefully developed and well-trained science education leadership group that serves the entire district.

The LSC support has enabled the SCC group to work with a range of outside experts over the years. The list includes known names such as Larry Lowery, Kathy DiRanna, Bob Garmston, Michael Fullan, Paul Black, and Jay McTeigh. However, two organizations have provided the most intense and extensive professional development experiences for this group — the Physics Education Group in the Physics Department at the University of Washington and the Exploratorium in San Francisco. The SCCs all completed at least 2 semesters worth of physical science content courses with the instructors from the Physics Education Group (PEG). In addition, scientists from PEG have worked with the SCCs for multiple years to co-facilitate workshops during the project's Summer Institute, providing opportunity to consider issues of both content and pedagogy. At the Exploratorium, the focus of the SCCs work was developing a deeper understanding of inquiry. The experience proved pivotal in designing some of the later LSC professional development opportunities — *Subtle Shifts*, for example.

Taken as a group, the team of Program Manager and SCCs represents the establishment of district-level staffing and instructional leadership for science that was non-existent prior to the LSC. Just like the Materials Center is the critical component to getting kits into classrooms, the training provided by SCCs is the reason that teachers feel prepared and confident to actually open up the kits and teach them. From our work in Seattle and other districts, we believe that both the materials center and the instructional leadership team are critical components of the infrastructure needed to maintain a high-quality elementary science program.

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| **CLAIM #4:** | **LSC staff have designed and delivered a high-quality, developmentally appropriate sequence of professional development experiences that support improved science instruction on a district-wide basis.** |

In the early years of the LSC reform effort, the program's professional development offerings focused on "getting it going" — that is, providing introductory training on the kits themselves, adult-level science content related to the topics of the kits, and grade-level-specific support sessions for teachers during the academic year. As time went on, teachers new to the project still needed this basic level of professional development, but participants from the early cohorts expressed interest in more advanced offerings — they were ready to move from "getting it going" to "getting it good." The science program responded with the creation of two new courses: *Subtle Shifts* and *Observations Lessons*. While project teachers have taken advantage of these opportunities to varying degrees, they have been available to all and remain in place. This year, the Seattle Elementary Science LSC provided a wide array of workshops that reflect the range of needs and interests among the district's elementary science teachers. These are not just a collection of stand-alone workshops, but a sequence of connected experiences for teachers. Each one has been carefully developed and thoughtfully refined. The table on the following page presents a list of all the courses the project offered.

**SEATTLE ELEMENTARY SCIENCE LSC PROFESSIONAL DEVELOPMENT OFFERINGS, 2001-2002**

| Course Name | Description | # of courses offered | # of PD hours per course | Dates |
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| *Science Content* (7 different courses) | adult level science content related to individual kits | 7 | 20 | Summer '01 |
| *Initial Use* (18 different courses) | training required to receive kit | 58 | 6*<br>*(2 courses are 9 hours long) | Summer '01, Fall '01, Winter '02, Spring '02 |
| *Data Analysis* | basic statistics, focusing on ways of integrating with lessons from the science kits | 2 | 24 | Fall '01, Winter '02 |
| *Subtle Shifts* | focuses on teaching strategies that promote stronger use of guided inquiry | 2 | 10-12 | Fall '01, Winter '02 |
| *Observation Lessons* | a modified version of Japanese "Lesson Study" in which teachers plan and observe actual lessons taught by their peers | 2 | 12 | Fall '01, Spring '02 |
| *Expository Writing – Introduction* | introduction to using science as a vehicle for teaching expository writing | 6 | 2-3 | Summer '01, Fall '01, Winter '02 |
| *Expository Writing – Grade Level Course in 3 parts* | a more advanced science writing course that offers teachers extensive classroom strategies for teaching writing through science with a focus on eliciting and interpreting student work | 18 | 4.5 | Fall '01, Winter '02, Spring '02 |

Since we began our work with the Seattle Elementary Science LSC, our research team has observed and independently rated the quality of 5-10 professional development sessions on an annual basis. Based on our ratings, there is a recognizable trajectory of continued improvement from one year to the next. This year we observed 7 sessions — a fairly representative sample of what the project made available to teachers. While there was variation across these sessions, the quality ranged from "solid" to "highly accomplished" professional development, an indication of the facilitators' skill and expertise. It is important to note that in addition to selecting sessions led by the SCCs, we intentionally observed sessions in which Lead Teachers served as facilitators. Lead Teachers now provide an important school-based layer of leadership for the Seattle Elementary Science LSC. They are full-time classroom teachers with an expressed interest in continuing to improve their own science teaching, who have been trained to run "Initial Use" workshops and to act as liaisons between the science project and the school. While

they do not have the same expertise as the SCCs, they have received extensive training from the SCC team and participated in numerous professional development experiences along with the SCCs themselves.

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| **CLAIM #5:** | **Teachers, principals and students express a high degree of satisfaction with and ongoing demand for the science program and continued support of the LSC staff and materials** |

Over the course of the evaluation, our research team has regularly come into contact with schools and teachers that are at different stages of implementing Seattle's kit-based elementary science curriculum. Some, after 5+ years of inquiry-based science, are deeply committed to the work. Others are just getting started. Consistently, however, we have encountered highly appreciative teachers who tell us how much more science they are teaching now than they did before and how much more their students are enjoying it. They tell us about how science is helping them in other subject areas, like writing. During randomly selected classroom observations, we meet students who tell us that science is their favorite subject and proudly show us their science notebooks. We talk to principals who tell us about the higher priority of science in Seattle and in the state of Washington and how even though they feel that there is too much reform in Seattle Public Schools, that this program came at just the right time.

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| **CLAIM #6:** | **Project leaders have worked to establish and expand local partnerships beyond the original circle that provided the foundation for the LSC grant.** |

Strong local partnerships started this grant and they continue to play a critical role in the work of this LSC. Between various departments at the University of Washington and local private sector organizations like Boeing, the project reports that over 400 professional scientists have been involved in the project to date, contributing nearly 30,000 hours of their time. Over its six-year history, the project has also benefited from partnerships with local non-profits like the Pacific Science Center and the Woodland Park Zoo. Most recently, the Seattle Aquarium, through a grant from the Howard Hughes Medical Institute, has provided funding and volunteer support for teacher professional development, as well as materials and fieldtrips, connected to the 4$^{th}$ grade "Ecosystems" kit. This emerging model whereby an outside agency can "adopt" an individual unit is a form of support that might be expanded in the future.

Local funders, such as the Stuart Foundation and the Alliance for Education, have provided supplemental monies for special efforts within the project, like the development of the Expository Writing courses in science and field trips for every child respectively. Even the City of Seattle has offered its support in the form of fieldtrips, microscopes, books, and teacher stipends.

The Seattle Elementary Science LSC has also developed local educational partnerships. For example, there are currently 5 Head Start classrooms participating in a Pre-K Inquiry-Based Science Program. By fall 2004, all 16 Seattle Head Start classrooms will have joined the Pre-K Science Program.

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| **CLAIM #7:** | **The work of the LSC has truly permeated the district, leading to a higher priority being placed on science at classroom, building, and district levels.** |

When the Seattle Elementary Science LSC began, it was perceived as operating outside of the district. Today, according to project teachers, the science program is increasingly viewed as woven into the fabric of the Seattle Public Schools. As one teacher insisted, "All classroom teachers are doing it. It's in every school."

As external evaluators, we have a growing sense that the project has achieved what we call a "permeating effect" in Seattle. Contrary to the views expressed at the outset of this project, district leaders recognize science as a core subject area at the elementary level. Other factors, particularly the announcement of the state-mandated elementary science assessment have also played a role in this change. However, the pressure to perform in math and literacy in an environment of high stakes accountability often detracts from science. In Seattle, many elementary teachers have become convinced that science can help them meet challenges in other academic areas.

According to project data, 94% of current Seattle elementary teachers have participated in some form of LSC professional development, meaning that the classroom experiences of nearly 21,500 students have been impacted by this grant (project estimates suggest that nearly 32,000 students will have been impacted by the end of the 6$^{th}$ no-cost extension). While we do not know how many hours of science each teacher is teaching, we can make some conservative estimates based on kit deliveries and professional development participation. For example, imagine that 94% of 1000 elementary teachers taught at least one kit per year. With 12 lessons per kit, we could probably estimate on average 12 hours of instruction per unit. This would equate to more than 11,000 hours of inquiry-based science instruction occurring each year.

When we observe elementary science lessons in Seattle classrooms, as we did this year, the vast majority of lessons are based on kits. Out of the 16 randomly selected lessons that we saw this spring, teachers were using kits in 13 classrooms. Of the other three, two teachers had completed their kit teaching for the year and the third was a teacher who claims not to teach the kits because they require too much training. Similarly, our teacher interviews indicate that it is a rare teacher who has not received training on at least one kit. Given the voluntary nature of the Seattle Elementary Science LSC, our experience in classrooms combined with teacher interview data leads us to believe that teacher "buy-in" is fairly widespread and growing.

Still, there is a big difference between getting training on a single kit and participating in 100 hours of professional development, which is the project's ultimate goal for all teachers. Project staff have tracked their success in achieving this goal across the different cohorts that have participated in the LSC. Data collected through this spring is provided in the table on the following page.

**TEACHER PROFESSIONAL DEVELOPMENT HOURS BY COHORT**

| | *# of teachers remaining in the district* | *% with 100 hours or more* | *% with 80<hours<100* | *% with 60<hours<80* | *% with <60 hours* |
|---|---|---|---|---|---|
| **Cohort 1** | 119 | 55% | 21% | 17% | 7% |
| **Cohort 2** | 81 | 49% | 19% | 25% | 7% |
| **Cohort 3** | 125 | 38% | 32% | 21% | 9% |
| **Cohort 4** | 191 | 20% | 24% | 28% | 28% |
| **Cohort 5** | 237 | 14% | 12% | 18% | 56% |

The table above lends itself to a variety of interpretations and bodes many questions. One conclusion, however, seem readily apparent: the more years of experience that a cohort has with the project, the greater the percentage of teachers in that cohort who have completed or are close to their 100 hours. Over 75% of cohort 1 teachers have 80 hours or more of professional development. 68% of cohort 2 and 70% of cohort 3 teachers have at least 80 hours of professional development. Of the teachers in cohorts 4 and 5, 44% and 37% have received 80+ hours of training respectively. It is important to note that the project has trained more teachers than the chart above indicates. The number of teachers listed represents those remaining in the district at this time and does not include teachers who have received LSC professional development but who are no longer teaching elementary grades or are no longer in the district.

**CLAIM #8: Classrooms observations indicate that full implementation of the program leads to higher quality science instruction.**

As in years past, we saw a range of grade levels, teaching experience, and instructional quality, across the set of 16 classrooms we visited this spring. Using the required classroom observation protocol provided by Horizon Research, we rated classrooms using the following scale:

5 = Exemplary Instruction
4 = Accomplished, Effective Instruction
3 = Beginning Stages of Effective Instruction
2 = Elements of Effective Instruction
1 = Ineffective Instruction

The majority of lessons we observed were rated in the 3 to 5 range, the full set of ratings spanned the entire range from 1 to 5. Despite this variation, among these lessons and over the years, across the entire collection of classrooms we have visited in Seattle's elementary schools, we see a pattern emerging that indeed connects the work of the LSC to classroom quality. The pattern is this: teachers, who had the most professional development experience and who taught kit-based lessons with the greatest fidelity to the units, provided the highest quality science instruction. The corollary is that teachers who had the least professional development and who were modifying the kits to meet their own needs provided lessons that were much more problematic.

For those who might be disappointed in the range of this year's classroom ratings, we want to point out that they are actually quite strong. The pool of eligible teachers was all elementary science teachers in the Seattle Public Schools – and more than half were teaching very respectable lessons. In all of the LSCs we work with, the quality tends to decline in the later years as more and more teachers are joining the project. In the early years, an LSC project tends to attract those teachers who have the greatest affinity for or interest in science. These often tend to be the teachers that have some prior knowledge of or commitment to inquiry-based teaching. However, in the later years, the effort necessarily focuses on bringing in those teachers who have not yet participated, some of whom tend to be the most hesitant, yielding a much broader pool.

What is so readily apparent in Seattle is the extent to which, even under voluntary conditions, teachers have embraced the work of the LSC. We not only see more science being taught, but we see more quality science teaching. The science kits provide a coherent, developmental sequence to teaching science at each grade level. Instead of teachers developing their own science lessons and units, the LSC has provided teachers with the materials, training and supports to offer all students regular, high-quality science learning opportunities.

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| **CLAIM #9:** | **The LSC science project has been both creative and successful in cultivating strands of curricular integration with other key subject areas — particularly writing and mathematics.** |

As indicated in Claim #4, the Seattle Elementary Science offers courses that help teachers use the science curriculum as a vehicle for enriching their instruction in other core subject areas – Data Analysis, designed and taught by Ellen Wijsman, and Expository Writing, created and led by Betsy Fulwiler. Teachers have appreciated both opportunities, particularly given Seattle's standards-driven context. However, the writing courses have evolved into something far beyond the notion that students should keep science "journals." With additional outside funding from the Stuart Foundation and under the leadership of one of the SCCs with a particular interest in this area, the project has provided a series of workshops designed to make expository writing in science not just a rhetorical idea, but a reality.

The SCC author has carefully scripted supplementary curriculum for each grade level and trained a cadre of Lead Teachers for science writing that provides support at the building level and during Initial Use courses, where many of them also serve as Lead Teacher facilitators. The courses not only help teachers recognize the symbiotic relationship between understanding science content and writing, but they also introduce instructional practices that empower teachers to make use of these ideas in their own classrooms. Our sense is that the extent to which Seattle teachers have embraced kit-based science has been strongly influenced by these opportunities for curricular integration. Teachers repeatedly comment on the Writing Courses during our interviews and in this year's classroom observations, 9 out of 16 lessons incorporated the project's designated science notebooks.

**CLAIM #10: Through the efforts of the LSC science project, the Seattle Public Schools has established a reputation as a regional and national leader in science education reform.**

Across the state of Washington, support for inquiry-based science is growing, as is the notion that science can be used as a vehicle to teach reading, writing, communication, and mathematics. The Washington State LASER (Leadership and Assistance for Science Education Reform), one of only 8 LASER sites across the country, plays a central role in promoting statewide implementation of a K-8 Science Education Program in all 296 districts—one that would align with the state science standards and support student success on the mandated science WASL exam for grades 5, 8, and 10. With its inquiry-based program already solidly in place, the Seattle Public Schools has surfaced as a leading district for science education in the LASER project.

In addition to serving as a model for what is possible, the Seattle K-5 Science Program has provided a base upon which others could build — leading to regional efforts that include another LSC, the *Seattle Middle School Science Partnership*. The relationship with LASER has led to connections with other schools district — for example, Stanwood-Camano, where the SCCs facilitate professional development and the Seattle Public Schools' Materials Center provides kits. As a result of this partnership the Seattle Materials Center is now a designated regional science materials resource center.

During the past year, all of the SCCs, as well as the Materials Center Manager, presented at national conferences. Many present regionally on a regular basis. In addition, the sharing that has taken place at the Exploratorium, during NSRC's Networking Forum at NSTA, and at the designated LSC PI meetings, has led to numerous requests for consultation on the part of the LSC staff. Both nationally and regionally, Seattle continues to attract attention in the science education arena, contributing to our sense that the Seattle Elementary Science LSC has served as part of a much larger movement at both the state and national level.

## Considering the Future

As a large, multi-year grant like the Seattle Elementary Science LSC faces its final months of NSF funding, questions about the future of the improvement effort take on a new urgency. Will everything that the district and science project have worked to accomplish over the past six years be maintained or allowed to simply fade away? We recognize that very few districts have the capacity to financially sustain the work of their LSC programs at a funding level similar to that of the grant. However, we also know that continuing to have such a program available for teachers and schools requires that the district provide some ongoing critical supports.

According to our experience with this systemic program and many others, districts need to supply some level of centralized support in order for the work that has begun to continue beyond the granting period. More specifically, if a district is truly committed to having a viable, ongoing

elementary science education program, then there are four components that must remain in place after the external funding is gone. They are as follows:

**(1)** a fully functioning **materials center** and the necessary financial support for maintaining all contents of the science kits

**(2)** an adequate team of **Science Curriculum Consultants** who can serve as full-time facilitators of professional development and instructional support for teachers

**(3)** a sufficient menu of **professional development** offerings that will enable the district to provide training for new teachers, to maintain flexibility among current staff (e.g., to accommodate grade level changes), and to allow teachers to have more advanced professional development opportunities

**(4) district-level leadership** in the form a designated point person with specific knowledge of the particular issues that pertain to elementary science

From what we know about the experiences of other districts, if *all* four of these critical supports do not exist at the district level, then the future of the science program is in serious jeopardy. Some combination is simply not enough. Without the necessary materials support, adequate training, instructional expertise, and leadership for science, the more than 11,000 hours of kit-based science instruction that is presently happening each year in Seattle's elementary schools will gradually atrophy and ultimately disappear. One should not be under the illusion that programs maintain themselves; without minimal critical supports high-quality elementary science teaching and learning experiences will not continue on their own.

In summary, then, we believe that the Seattle experience is a good example of how a well-designed, externally funded initiative can help a local district build the capacity to design and implement a high-quality science program. The key supports have been put in place, and while not complete, both the amount and quality of elementary science instruction in Seattle schools has increased significantly over the past five years. The question now for this district, as with all others funded by NSF, is whether or not it will be possible for the district to generate the will and resources needed to maintain the process of improvement that has been put in place.