

**Sustaining Improvement Efforts to Deepen
Middle-Grades Teachers' Science Content Knowledge:
The Case of System-Wide Change for All Learners and
Educators, the SCALE MSP in Los Angeles Unified School District**

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Introduction

The National Science Foundation's Math and Science Partnerships (MSP) program, established in 2002, involves science, technology, engineering, and mathematics (STEM) disciplinary faculty and K–12 districts in partnerships to improve the quality of mathematics/science education in the participating districts and to add to the knowledge base for education reform more broadly. More than 100 partnership projects were funded between 2002 and 2010, with plans to continue to support additional projects in the future.

The MSP Knowledge Management and Dissemination (MSP KMD) project is charged with synthesizing what the partnerships are learning in each of a number of key areas, and situating those lessons in the broader education improvement knowledge base. Lessons learned about deepening teacher content knowledge have been a particular focus of the MSP KMD work for two reasons. First, the MSPs have devoted a great deal of effort to the professional development of teachers of mathematics and science. Second, professional development is the intervention of choice in many mathematics and science education reform efforts in the United States, with the expectation that enhancing teacher knowledge and skills will lead to improved teaching and learning. Lessons learned about designing and implementing professional development, especially programs that involve STEM faculty, can enable program leaders to be more strategic in their efforts, using resources more efficiently, and addressing challenges more effectively.

In earlier work, the MSP KMD team developed the “Handbook for Enhancing Strategic Leadership in the Math and Science Partnerships” (Weiss, Miller, Heck, & Cress, 2004¹). That document suggests that strategic leadership in mathematics/science education improvement starts with understanding the system one is trying to improve. Strategic leaders then choose interventions that fit with the needs of that system, and are likely to be effective when implemented with the capacity that the partnership either already has or can develop. But capacity is not enough; at the same time, partnerships need to be sure that the system develops the will to improve, which involves getting key stakeholders on board, and ensuring that teachers get a consistent set of messages—from the partnership and from school/district curriculum, instruction, and assessment policies.

MSP KMD has conducted a series of case studies of MSP projects with the strategic leadership handbook in mind as a framework for understanding the partnerships between school districts and institutions of higher education. The goal was to describe how MSP partnerships were designed to foster sustained improvement in mathematics and science education, the nature of the challenges that these partnerships faced, and how those challenges were addressed, to help inform future efforts at system improvement.

This chapter is one of four case reports; it describes the “System-wide Change for All Learners and Educators” Math and Science Partnership, a partnership between four urban school districts across the country (Los Angeles Unified School District, Madison Metropolitan School District, Denver Public Schools, and Providence Public School District) and the University of Wisconsin's Center for Education Research, with other higher education institutions serving as partners at each of the sites. Although the project addressed both mathematics and science across all of the grades, K–12, this case focuses on middle-school science in Los Angeles Unified School District. A cross-case analysis can be found [here](#).

¹ Weiss, I. R., Miller, B. A., Heck, D. J., & Cress, K. (2004). *Handbook for enhancing strategic leadership in the math and science partnerships*. Chapel Hill, NC: Horizon Research, Inc., http://www.horizon-research.com/reports/2004/mspta_handbook.pdf.

Vignette

It's the start of a new school year. A Los Angeles Unified School District middle school principal welcomes new students. In years past, this principal may have been welcoming many new teachers as well, but the high-turnover tide seems to be ebbing. She did not have to hire any new science teachers this year. In fact, the science teachers on staff genuinely seem to be enjoying their work. The district has been emphasizing the importance of high quality science instruction, and has been equipping teachers with the tools they need to teach effectively. The teachers have access to standards-aligned instructional materials and professional development on these materials led by the science supervisors, lead teachers from district schools, and local university faculty. The principal sees that the students are motivated to learn science; they seem like young scientists, asking questions, analyzing data, and drawing evidence-based conclusions. Her hope is that having experienced such success in the classroom right from the start, these teachers will be motivated to stay in the district for years to come.

The System-Wide Change for All Learners and Educators MSP

In 2003, System-Wide Change for All Learners and Educators (SCALE) was awarded a \$35 million Math and Science Partnership grant by the National Science Foundation. SCALE was a partnership of four urban school districts across the country (Los Angeles Unified School District, Madison Metropolitan School District, Denver Public Schools, and Providence Public School District) and the University of Wisconsin's Center for Education Research, with other higher education institutions serving as partners at each of the sites. The University of Pittsburgh's Institute for Learning was originally a lead partner, but discontinued its involvement early in the project.

Across sites and grades, SCALE aimed to improve K–12 mathematics and science instruction; its goal was for every student to experience deep, conceptually-based instruction on core mathematics and science concepts. This report focuses on the work of SCALE to deepen teacher content knowledge in the Los Angeles Unified School District (LAUSD), with a specific focus on the middle school science component of the work. Changing instructional practice is a challenge in any district, and in LAUSD the district's size made it a huge task to initiate such change. SCALE addressed the task with substantial investments of funding and time. Approximately \$12 million of the MSP award was expended in LAUSD, with roughly 40 percent of those funds devoted to SCALE's work with middle school science teachers.

SCALE's science project in the Los Angeles basin (SCALE-LA) was a partnership that started between the University of Wisconsin and LAUSD, but only really began to gain significant momentum once California State University Dominguez Hills became part of the project structure. Through the connections at California State University Dominguez Hills, California State University Northridge also became a partner in this effort. The centerpiece of the science education work at the middle grades was a set of immersion units, with the professional development provided to teachers to implement the units. As noted in the introduction to Exploring Earth: Plate Tectonics, the 6th grade earth science immersion unit, immersion units provide "a coherent series of lessons designed to guide students in developing deep conceptual understanding that is aligned with the standards, key science concepts, and essential features of classroom inquiry (as defined by the National Science Education Standards)." The immersion units differed from the materials that middle grades teachers had been using to teach science in

that they were designed to engage students with science ideas by asking them to work as scientists. As the Plate Tectonics unit materials note, when using these units students are “making observations, asking questions, doing further investigations to explore and explain natural phenomena, and communicating their results based on evidence.”

This report considers the vision, planning, implementation, and sustainability of SCALE’s work in middle school science education in Los Angeles, although work at the secondary level was similar. The subsequent sections provide the context for science education reform in LAUSD; SCALE-LA’s focus, goals and plans for the work of deepening the science content knowledge of middle school teachers in LAUSD; how those plans played out over time; key factors in the implementation of the work; and the likelihood SCALE-LA’s science education reforms will have lasting impact.

The Context for Science Education Reform

LAUSD is the second largest public school district in the United States, with more than 700,000 students enrolled at the time the SCALE-LA grant was awarded in 2003. At that time, over 70 percent of those students were classified as Hispanic, 12 percent African-American, and 9 percent white. Just over 40 percent of students were English Language Learners, and the proportion rose over the course of the grant. LAUSD has historically struggled with low academic performance of students, along with high dropout and expulsion rates. The district has also experienced high rates of teacher turnover. In the 2007-08 school year, for instance, about 45 percent of LAUSD teachers had fewer than six years teaching experience. As is common in large urban districts, administrative leadership also changes frequently. At the time the MSP grant was awarded, LAUSD was led by a superintendent who supported SCALE-LA throughout his tenure, which ended in 2006. A new superintendent came in with new priorities, but his contract was bought out two years later. SCALE-LA came into a system, then, that faces chronic personnel instability.

LAUSD was included in SCALE’s MSP proposal because the district had worked previously with the Institute for Learning at the University of Pittsburgh—an original partner in the MSP proposal. In addition, LAUSD had a history with NSF. In 1995, LAUSD received a \$15 million grant from NSF to provide a standards-based instructional program for all students, raise student achievement, and close achievement gaps. In 2001, the district received an Urban Systemic Program grant from NSF, for an additional \$15 million, to continue the work. As part of the Urban Systemic Program, six centers were created that housed science education advisors who offered professional development to teachers and provided supplies and resources for classroom instruction. Professional development opportunities through the centers consisted of voluntary, after-school workshops focused on specific science topics. A SCALE project leader had the perception that workshop participants received kits to take back to their classrooms, but that there was little or no follow-up. The centers were ultimately discontinued due to district budget cuts. Said a district science educator, “When the Urban Systemic Program went away, everything that came with that program disappeared.”

SCALE-LA project leaders perceived that in spite of the work that had been undertaken in prior NSF grants, LAUSD lacked strong science education capacity. At the time the grant was funded, there were two central office science supervisors, one in charge of elementary and middle school, and the other high school. In addition, the district was divided into eight local districts and each district had two or three science education experts, advisors, or specialists, each of whom was responsible for supporting the efforts of a large number of science teachers. Shortly after the SCALE-LA grant was awarded, the district created a position for a secondary science director. This director established a secondary science branch, noting that at the time he was appointed, “It was kind of disjointed in L.A. because there was no leadership.”

SCALE-LA was able to build momentum through the new science director, who was interested in the immersion unit approach. He facilitated the development of a district science plan in 2003, and SCALE-LA work was linked to that plan. There was recognition within the district that middle school science teachers—especially 6th grade teachers who were likely to teach both mathematics and science with only general education certification—needed to strengthen their knowledge of science content and inquiry-based teaching.

Capacity was available to support SCALE-LA through the California State University system. While there was not an ongoing, structured partnership between LAUSD and the university system, there was a history of two nearby universities offering professional development opportunities to LAUSD teachers. California State University Dominguez Hills (CSU Dominguez Hills) operated the Center for Mathematics and Science Education, which offered three-week mathematics institutes to teachers. Similarly, California State University at Northridge (Cal State Northridge) has been a California Science Project site for the San Fernando Valley, holding week-long summer institutes and monthly workshops for LAUSD teachers in grades 4–8. SCALE-LA would be able to tap into these existing structures to offer institutes on the science immersion units to teachers. In addition, CSU Dominguez Hills had recently led another NSF grant, the Los Angeles Collaborative for Teacher Excellence, and saw an opportunity to explore a different model of partnering with a school district.

Focus, Goals, and Plans for the SCALE-LA Work

A focus on deepening teacher content knowledge was clear from the goals in the SCALE proposal. SCALE-LA wanted to develop a core science, technology, engineering, and mathematics instructional program for students, facilitated by the development of immersion units and coherent professional development for teachers. The vision was to use a partnership between the school district and the local universities to design and implement the units and accompanying professional development. Embedded in this work were the goals of developing a unified K–16 vision of what science instruction should look like, developing the capacity of LAUSD staff to implement and continue the work beyond the SCALE-LA funding period, and developing an ongoing partnership among CSU Dominguez Hills, Cal State Northridge, and LAUSD. Elements of the SCALE-LA that addressed teacher content knowledge included:

- Developing a core instructional program,
- Developing and implementing immersion units,

- Designing and implementing professional development to support teachers' implementation of immersion units, and
- Strengthening the partnership between LAUSD and institutions of higher education.

A Core Science Instructional Program

SCALE sought to change science instruction from a textbook-based approach to an instructional program that would take students deeply into the conceptual core of science. The first step toward accomplishing this goal was to help the participating districts, including LAUSD, implement core instructional programs that would teach the central concepts of science. SCALE leaders noted at the outset that none of the partner districts had in place a coherent and cumulative K–8 science program. Instead, many teachers, especially at the elementary level, pursued independent views regarding which science topics were important. In addition, although the districts had science content standards, they did not test science or use it in their accountability systems. As a result, teachers felt little pressure to implement science programs that aligned with the standards, and students didn't experience a program of science in which the curriculum built from one grade to the next. SCALE's goal was to work with LAUSD (and the other districts) to develop a coherent and cumulative K–8 science program, starting with its science content standards. SCALE-LA also intended to work with the districts to initiate assessment programs aligned with state science goals.

SCALE's plan to establish a core instructional program for all students (K–12) also included the development of an in-service professional learning framework for science instruction. The Institute for Learning at the University of Pittsburgh was to coordinate implementation of this plan, assigning a staff member to serve as a liaison to each partner district. In addition, each school district would designate an MSP coordinator. SCALE project leaders noted that they did not intend to specify a single instructional system for all four partner districts. Rather, they hoped to assist each district in developing a clearly articulated theory of action about the kind of teaching needed to develop student understanding of science, to select programs to match the theory, and to develop tools and protocols that districts could use to monitor how well the intended system was being implemented.

The professional learning framework included four dimensions: teaching, professional learning, monitoring, and accountability. The strategies and benchmarks for implementing the teaching dimension included developing shared visions of, and standards for, effective science teaching, as well as defining science curricula and tools for monitoring their implementation. SCALE would assist districts in developing a timeline for adopting policies to address the agreed-upon components, it would also develop rubrics for monitoring districts' progress toward implementing the policies. Districts would later use these rubrics to frame annual reports on learning policy implementation.

The professional learning dimension was to be focused on preparing teachers, principals, and district leaders to implement the new vision for science instruction. This dimension of the plan called for the development of coaches and lead teachers in science, with project staff including Institute for Learning liaisons, providing coach/lead teacher training along with guidelines for selecting and evaluating coaches. In addition the project would provide training to principals

and supervisors, along with rubrics for assessing their instructional leadership in science. SCALE-LA also intended to establish professional learning communities within schools.

The monitoring dimension was to be designed to help administrators gauge how schools were doing in implementing science programs. The accountability dimension was to be focused on helping districts determine how they would operate within or beyond state accountability requirements to ensure improved student achievement in science.

Immersion Units to Support the Core STEM Instructional Program

The centerpiece of the core STEM instructional program was to be science immersion units, several at each grade level 6–8. A project leader and immersion unit developer remarked that “the absolute goal [of the SCALE-LA] was to unify a K–16 vision for what science could look like in a classroom.” The rationale was that immersion units offer learning opportunities to students that are consistent with three characteristics of authentic intellectual work: construction of knowledge, disciplined inquiry, and value beyond school. It was believed that students need to not only learn core science concepts, but also to understand the scientific enterprise by becoming immersed in science investigations. Project leaders asserted that immersion units would create learning situations in which students could organize, synthesize, and interpret information in addressing key scientific ideas or issues; investigate key concepts using carefully-constructed instructional materials; elaborate on their new understandings through scientific communication; and connect the concepts and their new understandings to real-life experiences and events.

A practical reason for using the immersion unit approach was that leading project partners at the University of Wisconsin and the University of Pittsburgh had experience developing investigation-based projects, which had been implemented on a pilot basis. Preliminary results suggested that these sorts of projects were engaging and interesting to students. For example, through two GK–12 awards (with the same PI and many of the same participating faculty who then played a role in SCALE) the University of Wisconsin’s work included having teams composed of district and university personnel develop classroom materials and then lead professional development to support teachers’ implementation of the materials. Based on that work, they were interested in partnering with a district to further develop this model of materials development and professional development. SCALE-LA leaders hoped that by using immersion units as a focus of their work, quality science instruction would become available to all students.

The project would develop criteria for defining immersion units—the Nine Principles of Immersion—that would parallel the Institute for Learning’s Nine Principles of Learning. A concept paper would be developed outlining the criteria and providing initial plans for aligning immersion units with standards, assessments, and testing within the partner districts. An Immersion Design Team consisting of national project leaders would design a template for the immersion units.

The initial vision for the development of immersion units for use in LAUSD was that University of Wisconsin faculty would have primary responsibility for developing the units, with input from a Los Angeles-based immersion unit team. The Los Angeles team would consist of an experienced curriculum writer; a facilitator; a district staff member who could be a teacher,

advisor, or administrator; and science content faculty and education faculty from Cal State Northridge and CSU Dominguez Hills. The plan was for University of Wisconsin developers to meet with the local advisors, then return to Wisconsin to develop the units. Once developed, the units would be handed off to the Institute for Learning at the University of Pittsburgh for distribution and implementation. It was assumed by some project leaders that dissemination would occur from the top down within LAUSD because the Institute for Learning had forged relationships with the superintendent, and was accustomed to working with top-level leaders.

In order to obtain LAUSD buy-in and to ensure that the topics matched district standards and expectations, SCALE leaders planned to have LAUSD leaders select the topics for the immersion units. Project leaders suggested some parameters for choosing topics to LAUSD; i.e., the topics should be areas in which students performed poorly on the state test and/or topics that were difficult for middle school teachers to teach. The hope was that selecting topics based on these parameters would ensure that the units met the needs of LAUSD science teachers and students.

Serendipitously, buy-in from LAUSD to the immersion unit approach was facilitated by the appointment of the new secondary science director, who was attracted to immersion units because they were relatively inexpensive, and because he believed that developing the units locally would build collaboration and capacity:

People thought immersion could be STC kits or other forms of extended investigation such as off-the-shelf FOSS kits.² I saw that we could not afford to spend \$3,000 per classroom per kit for these teachers, nor did I think it prudent. I said, “Let’s make sure immersion is \$200 or less per classroom so teachers can get what they need to do to the unit” ... I said we need to do something that evolves toward collaboration, using our expertise to develop curriculum so that it is teacher-developed, the union and the district approves, and the university supports it... It became a co-construction model of scientists, teachers, district, higher education people—and at a price we could afford.

A Coherent Teacher Preparation and Development Plan

One key to transforming the instructional program would be offering professional development to teachers around the immersion units. The goal of this professional development, according to early project documents, would be to “give teachers a deeper grasp of STEM content and effective pedagogical strategies for engaging students in learning that content.” The in-depth content focus of SCALE was in response to the perception that middle school teachers lacked a strong background in science content and pedagogy, and needed instructional materials and professional development to support growth in this area. The long-term goal was to influence teacher pre-service preparation at the partner universities and then continue with content-focused professional development throughout teachers’ careers.

The plan for designing professional development was for the project-level Immersion Design Team to work with the district-level immersion unit team to train teachers in the immersion unit content and implementation. This work would be designed to familiarize teachers with the

² The science director is referring to commercially available science kits from Science & Technology for Children® (STC) and Full Option Science System (FOSS).

Principles of Immersion and provide them the experience and expertise to immerse their own students in extended investigations and to help train other teachers.

The first phase of SCALE-LA's work would involve workshops that actively engaged teachers and coaches in LAUSD in the processes of learning and doing science investigations in order to build teacher competence and confidence in using immersion unit material. In the first year, a group of LAUSD lead teachers would be trained in the pilot *Fast Plants* immersion unit. They would then train a second tier of teachers during LAUSD in-service workshops. In the second year, immersion units would be developed and piloted at different grade levels. SCALE-LA and the Institute for Learning would also provide principal and supervisor training for each of the districts.

The project planned to support the professional learning opportunities offered to teachers through school-based learning communities. The strategic plan called for content-focused teacher study groups, cross-visitation of classrooms by teachers (often with principals and coaches), sessions focused on analysis of student work and cooperative grading sessions, and other activities focused on analyzing curriculum and teaching and on improving student achievement. SCALE's strategic plan also called for creating and maintaining a support network for participating teachers that might involve establishing a district-based leadership team comprised of a team manager and team support personnel; offering ongoing support through website resources; or linking teachers, students, researchers, and evaluators who were using the same immersion unit. The idea was to engage not only teachers and coaches, but also principals, supervisors, and administrators, to develop a professional learning community with a focus on science instruction.

K–12 and Higher Education Partnerships

SCALE project leaders believed the key to creating a career-spanning professional learning system was to link teacher preparation institutions within a region to the school districts that employ their graduates. In Los Angeles, CSU Dominguez Hills and Cal State University at Northridge were targeted because these two institutions sent a majority of teachers they prepared into jobs in LAUSD. As noted above, both universities had long offered professional development opportunities to LAUSD teachers, but there was no structure in place for ongoing communication between LAUSD and the universities to enable alignment of goals and activities between the K–12 and higher education system. SCALE-LA planned to create an infrastructure for such collaboration that would facilitate the continued implementation of MSP-like opportunities after the grant period.

University of Wisconsin project leaders hoped to facilitate the creation of this infrastructure by bringing together university faculty to explore the benefits of an ongoing partnership between the universities and LAUSD, and how the universities could work with the district to obtain grants to support such a partnership. Project leaders envisioned a one-year course that focused on the essence of solid grant writing, and how to merge ideas between the universities and the LAUSD.

To create an ongoing, working partnership between the LAUSD and the California State Universities, "boundary crossers" would be identified to make sure that university faculty were present as the district planned its science professional development for the year. This professional development was intended to be a collaboration between the district and the

universities in which university faculty would be fully involved—not just attending for two hours to present science content.

The partnership between LAUSD, CSU Dominguez Hills, and Cal State Northridge would be forged early on through their involvement in designing the science immersion units, and in designing and delivering the professional development that would be offered to teachers on the units.

SCALE-LA in Action

The science immersion units came to serve as a focal point of SCALE-LA, with the project goals becoming integrated around the immersion units and the professional development supporting the units. Some of the plans for implementing the core instructional program were executed; however, development of the core instructional program was to be led primarily by the Institute for Learning, which left midway through the project. This exodus likely contributed to an increased focus on the immersion units as the vehicle for integrating SCALE-LA's goals. As a consequence, less attention was given to the components of the work that had been under the purview of the Institute for Learning, including the monitoring and accountability dimensions. The sections that follow acknowledge progress made toward the development of the science instructional program as a whole, but focus primarily on the immersion units and the accompanying professional development.

Developing a Core Science Instructional Program: Narrowing the Focus

The Institute for Learning assumed primary responsibility for implementing the four dimensions of SCALE's plan to develop a core science instructional program in each district: teaching, professional learning, monitoring, and accountability. Actual implementation of this goal focused primarily on the teaching and professional learning dimensions.

The teaching dimension was to include development of science curricula and a shared vision of effective science teaching. The Institute for Learning concentrated on developing district-wide curriculum planning tools, which were used in LAUSD to define their district teaching systems for science. Under the SCALE-LA's guidance, science instructional guides were developed and later revised. This work, along with the intensive work around developing immersion units and professional development, contributed to the development of a shared vision for effective science teaching among the district and university partners.

The middle school science professional learning dimension included training lead teachers to facilitate summer institutes (i.e., professional development on immersion units). In addition, four, two-day K–12 Science Leadership Institutes were held to support district leaders in understanding and applying research on systemic science reform, and to build their capacity to employ a coherent approach to teacher professional development. These lead teachers received a small stipend for the non-school days in which they participated in these trainings and facilitated the Institutes. On school days, they were provided with funding to cover their classroom substitutes.

The Institute for Learning believed it had met most of its objectives in the teaching and professional learning dimensions and wished to redirect its efforts and substantial SCALE resources to the monitoring and accountability dimensions of the work. Other members of the leadership team did not think this redirection would meet the identified needs of districts; consequently, the Institute for Learning decided to withdraw from the project. Because LAUSD and some SCALE leaders wanted more MSP resources to be directed toward professional development and classroom implementation, the Institute for Learning's departure supported a movement that was already underway to focus SCALE-LA's work increasingly around the immersion units and professional development to support the units needed to be designed and implemented.

Creating Immersion Units: The Vehicle for Science Education Reform

The first step in developing the immersion units was to identify topics. Using the parameters set out by SCALE leaders during the planning phase, LAUSD leaders selected a topic for each middle-school grade level: Plate Tectonics (Grade 6), Variation and Natural Selection (Grade 7), and Density and Buoyancy (Grade 8). The materials were to be designed as four-week units in which students, working like scientists, investigate a topic.

The initial plan for the development of immersion units was that SCALE liaisons from the University of Wisconsin would have primary responsibility for developing the units. The liaisons would consult with the LA-based immersion unit team, then develop the units off-site. The SCALE liaisons found that local science expertise was essential, and hence this "over the wall" approach did not work. Faculty at CSU Dominguez Hills had been working on another NSF grant, the Los Angeles Collaborative for Teacher Excellence, and SCALE enlisted their support in designing the units. Their expertise proved invaluable and CSU Dominguez Hills took on a central role in SCALE-LA.

The SCALE liaisons traveled to LAUSD every other week to develop the immersion units with the local team, which included LAUSD district staff and teachers, and California State University science and education faculty. To support the greatly increased involvement of CSU Dominguez Hills faculty in the development of the units, the project worked with CSU Dominguez Hills math and science leadership in a successful effort to secure a \$4 million grant from the U.S. Department of Education. District staff and teachers received small stipends for development work on non-school days, and teachers received substitute pay on school days; faculty received release time from their university work. The launch of this new project was a very interesting moment—would the newly-engaged CSU Dominguez Hills science faculty integrate well with the LAUSD science leaders and the emerging immersion unit, professional development co-construction model, or would the first meeting effectively be the last? In fact that first meeting was the launch of what some consider to be SCALE's most impressive accomplishment—its impact on LAUSD middle school science instruction and professional development.

This local involvement helped build ownership and momentum for the immersion units. It also created a collaborative partnership around a shared vision of science education. One project leader noted that there was a strong need for LAUSD and California State University faculty to

learn more about one another, and how to talk to one another to develop a common vision for science learning:

The process of developing the unit was a tremendous learning tool for the leadership in the district and the universities. All of a sudden we had people in the same room trying to come up with a common vision for instructional materials, and these were people working for the same system. I don't even know the word to describe how far apart their visions were for teaching and learning.

External project leaders reported that there was a “soft science war” in the district at the project’s inception between those who wanted to move to a more hands-on approach, and traditionalists who feared that this approach would result in teachers not covering all of the required standards. Project leaders took advantage of the opportunity to present the immersion unit approach as a way to do both:

Science immersion seemed like a nice opportunity to say to the district, “Let’s craft materials that address the concepts that are in your instructional guides that are to be taught, but that you know you are having a hard time teaching and you don’t have materials to teach it.” That served as a way also to bridge this kind of discrepancy among the science leadership about what good science teaching and learning looks like.

Alignment of the units with the LAUSD science standards became an increasing focus of the work over time. The 7th and 8th grade units incorporated some of the LAUSD standards, but they did not cover all of the standards for the topics that LAUSD teachers were required to teach. As a result, the 7th and 8th grade immersion units were not as widely implemented as they might have been. By the time the 6th grade Plate Tectonics unit was developed, project leaders realized that the unit would need to cover all the standards or teachers would not teach it. Consequently, the unit incorporated one of the district’s 6th grade instructional components almost in its entirety, and has been more widely implemented as a result.

Designing Professional Development: Building Capacity within the System

After the first immersion units were developed, the SCALE liaisons brought the units back to the local team to design professional development around the units. The SCALE liaisons quickly realized that even though district and California State University faculty had helped design the units, they lacked the necessary knowledge and skills to conduct professional development on them. Out of this realization, the Professional Development Study Group was developed as a method of simultaneously designing the teacher professional development program and preparing California State University and LAUSD faculty for facilitating the institutes.

The Professional Development Study Group consisted of about 60 people representing LAUSD teachers, district science advisors, science faculty, and science education faculty. The Study Group met with the SCALE liaisons twice a month on Friday and Saturday for a period of four months to develop the summer institutes for the immersion units. The larger group was divided into smaller facilitation teams by grade level, who practiced the professional development for one another until they had it ready for use with the teachers. Fine tuning of the materials continued during the summer institutes for teachers, when the teams met at the end of each day

to debrief and plan for the following day. Similar to the incentives for contributing to the development of the immersion units, district staff and teachers received small stipends for their time on non-school days, teachers received substitute pay on school days, and faculty received release time from their university work for their efforts to prepare for and facilitate the Institutes.

Each fall after the summer institutes, the Study Group reconvened for three separate meetings. During the first meeting, they reviewed evaluations from the institutes (their own, as well as those of participants). The second meeting was scheduled after the teacher follow-up sessions to debrief on how those had gone. The last meeting of the year focused on how to take what the group had learned and apply it to professional development planning and implementation in general.

Participants in the Study Group, as well as the SCALE liaisons, found the process to be a powerful form of professional development, developing the capacity of participants to continue this kind of work. Some participants reported that the study group approach had been adopted in designing and implementing all science professional development within the district. Said a teacher participant in the study group:

They're trying to make more of a unified professional development experience in our district, and a lot of it is based on the things that we learned about in our Professional Development Study Group. Like the Deborah Ball model is now standard—every district professional development, we use that—things that we learned in that study group.

Implementing Professional Development: Collaboration, Compromise, and Support

SCALE project documents outline a professional development plan that included institutes for teachers around the immersion units, follow-up support for implementation in the classroom, and professional development for administrators. Of these experiences, the summer institutes were developed most fully.

The decision to offer intensive summer institutes around the immersion units was a compromise; some LAUSD staff interpreted the research as showing that it would be more effective to offer a brief introductory workshop on the unit, have teachers try the materials, and then come back for an intensive experience later on. On the other hand, some university faculty believed that an institute of 2–3 weeks would be needed to cover the unit in sufficient depth. The partners settled on five-day institutes as a kind of middle ground, taking into consideration the amount of time teachers would be available during the summer and with a goal to reach as many teachers as possible. For attending the institutes, teachers received up to \$1,200, which included \$500 for a five-day summer workshop, \$200 for two half-days during the academic year, and an additional \$500 upon completion of a product that typically included analyzing and presenting student artifacts from the unit. For teachers in year-round schools, substitute pay was provided in place of the stipend for the workshop.

Summer institutes were offered for four consecutive summers, providing professional development focused on the immersion units for many teachers each summer. For instance, in Year Four of the project, there were four institutes for science teachers at grade levels six and seven and three institutes for eighth-grade science teachers in addition to offerings at other grade

levels and in mathematics. Although laboratory space limited the number of participants in the science institutes, between 20 and 30 teachers could be accommodated and most institutes served at least 20 teacher participants.

Vignette

It's the third day of a five-day Institute. Kim,³ a lead teacher at a LAUSD middle school, sits with her co-facilitators to review the agenda for the day. Things have been going well so far. The teachers seem eager to work with the Plate Tectonics unit being presented. These teachers often have to cobble together various activities for a Plate Tectonics unit in order to address the district science standards, and many of these teachers are new to the field, with limited instructional tools and experience to rely on. But almost everything is at their fingertips with this unit.

Today, the teachers will continue to experience the lessons as learners; they will also have time to reflect on what the key science concepts of those lessons are, why the lesson is important to the unit, and what kinds of inquiry strategies are being employed. The teachers seem to be enjoying the opportunity to experience and think about the ways in which scientists work. They also seem to be appreciating the opportunity to learn more about the content as most of these teachers do not have a background in geology outside of an introductory geology or earth science course. Having Paul, a geology professor from the California State University at Northridge, as a co-facilitator has been invaluable in addressing the teachers' questions about the subtleties of the content. He has been working with teachers for several years now. He is grounded in the work of K–12 teachers, including some of the common issues that complicate their work (e.g., classroom management, discipline), and he understands the vision of effective science instruction that the district is aiming for.

Kim enjoys co-facilitating these sessions. She has been using this particular unit for a few years now, and even helped design the professional development for it. She's had a lot of success in helping her students understand this content as well as orienting them to the ways in which knowledge is accumulated in science, for instance, making evidence-based claims. She has a lot to offer the teachers in the way of implementation tips, such as assessment strategies and pacing.

Each professional development session was presented by a science education faculty member, science faculty member, district staff member, and lead teacher—all of whom had been prepared through their work as part of the Professional Development Study Group. These four-person teams were selected from a pool of approximately 10 facilitators who were capable of facilitating the institute for any particular immersion unit.

The format for presenting at the institutes was called the SCALE Immersion Model for Professional Learning (SIMPL),⁴ developed by University of Wisconsin project leaders. The SIMPL model is based on Nanette Seago and Judy Mumme's "Circle of Learning,"⁵ a framework adapted from previous work by David Cohen and Deborah Ball⁶ that illustrates what students, teachers, and teacher leaders need to know and be able to do. (See Figure 1.) As indicated in the framework, SCALE's professional development for teachers addressed relationships between students, content, and teachers, while in the Study Group potential

³ Pseudonyms have been used.

⁴ Baxter, H. & Lauffer, D. (2007, October). *The SIMPL approach to science education reform*. Unpublished manuscript. Madison, WI: University of Wisconsin-Madison, Wisconsin Center for Education Research.

⁵ Seago, N. & Goldsmith, L.T. (2006). *Using videocases to learn mathematics knowledge for teaching*. Paper presented at the annual meeting of the American Educational Research Association, San Francisco, CA.

⁶ Cohen, D. K. & Ball, D. L. (1999). *Instruction, capacity, and improvement* (CPRE Research Report Series, RR-43). New Brunswick, NJ: Consortium for Policy Research in Education.

facilitators went beyond those relationships to consider teachers as learners. SIMPL is a “model for taking time to work together to understand both *what* is taught in the Immersion Unit and *why* it is designed to support effective teaching and learning.”⁷

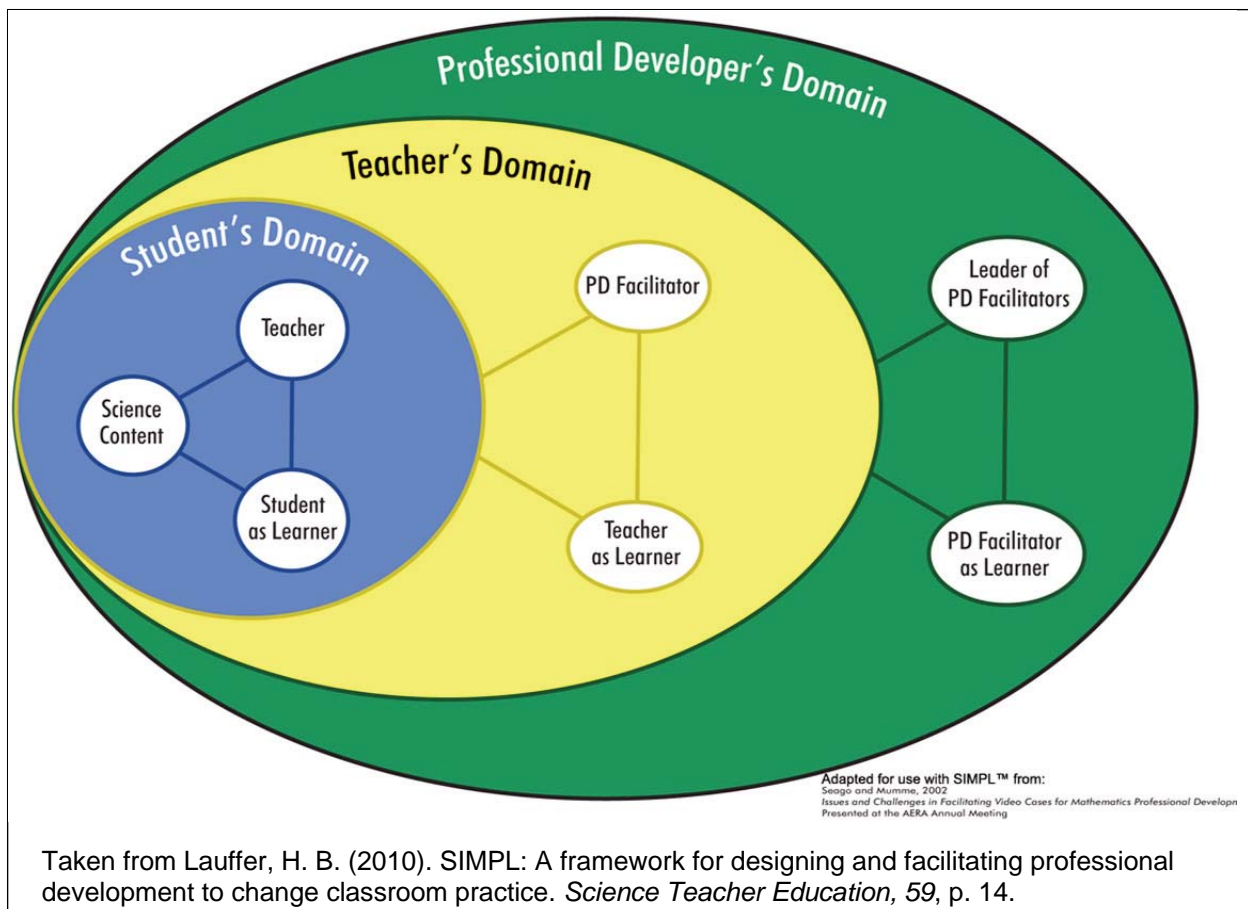


Figure 1: the SIMPL model.

SCALE facilitators moved through and among “engage-explore-explain” modes during the institute, using a linear diagram to make clear to participants the mode in which they were operating at any given point. (See Figure 2.) The idea was to first engage teachers in a discussion about the concepts that were to be presented. Facilitators then moved an arrow on the diagram to the “explore” mode, and modeled the lesson. During this time, teachers were instructed to stay within the student role. When the arrow was moved to the “explain” mode, participants were permitted to go back into teacher mode and discuss what it would take to conduct that lesson in their own classrooms. A project leader explained how the SIMPL model enabled teachers to stay in the learner role and experience the lessons as students:

⁷ Garcia, E. M. (Winter 2009). *Immersion Units for the Secondary Science Classroom*. The Ladder: Innovation in the Classroom. Los Angeles, CA: LAUSD Human Resources Division Career Ladder Office.

Before [in prior professional development we had done], we modeled the lesson and stepped back, but we didn't have a graphic to explain visually when we were stepping back. Without that visual, I think we were less clear about when we were doing which part of the learning.... The SIMPL model makes it really clear that this is what will happen, and you will have a chance to step back and talk about how it will play out as a teacher: "We will get to that, but right now you need to stay in the learner role." Somehow it lends enough credence to the model that facilitators implement it with greater fidelity, and participants stick to it. The result is you get better content learning because they stay engaged as learners. One phrase you hear in professional development is, "This content is too hard for my students." Translated, that means, "I don't get it, and I am kind of embarrassed, and I would rather talk about my kids not being able to get it than show my own ignorance." So having a model where that conversation is not allowable makes people stick with learning. It also gives them an opportunity to really experience, without the choppiness, the kind of teaching and learning you want to model. If you are trying to model really good inquiry-based instruction, and every 15 minutes someone interrupts to ask questions about how you would do it in the classroom, it breaks the flow and doesn't give people the opportunity to feel how cool it is to engage in inquiry. They don't learn the process standards you want them to learn.

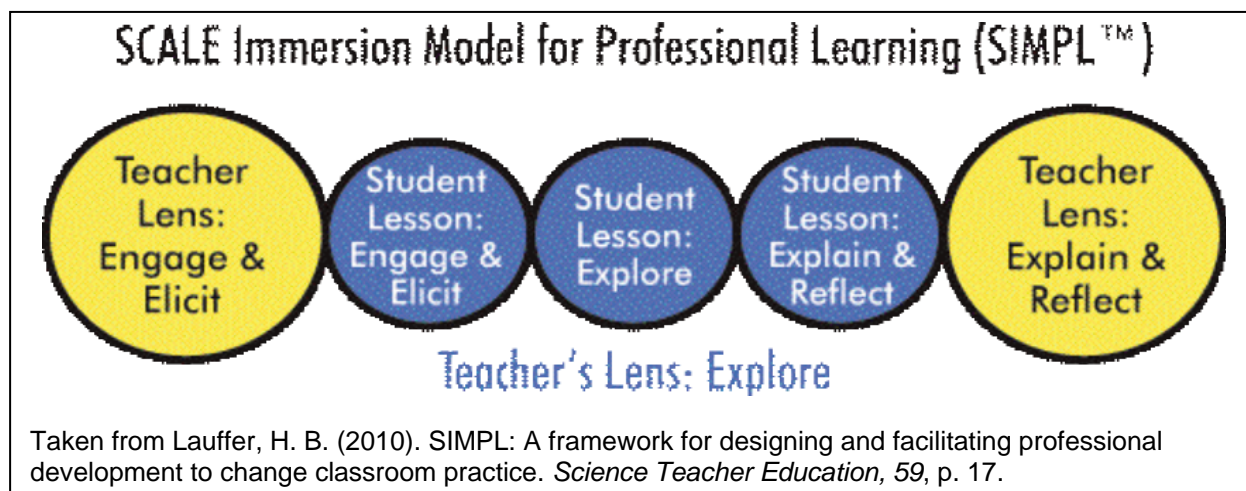


Figure 2: SCALE Immersion Model for Professional Learning

Project leaders indicated that the summer institutes encompassed disciplinary content knowledge, pedagogical content knowledge, and “science as a way of knowing.” Said one:

We started off with a focus on the instructional materials, on the content in the instructional materials...As we evolved...we were able to really focus on what the instructional materials do in terms of supporting teachers' background knowledge about discipline-specific content, as well as background knowledge about pedagogical strategies, and equally important, their background knowledge about science as a way of knowing.... Then the professional development we provided for them was definitely

focused around elevating teacher content knowledge by having them engage as learners in the lesson so they would learn content to fit lessons specifically, and have them go deeper than that in reflecting on the lessons and the pedagogy of the lessons.

One project leader reported that they tried to do it all, and could have used more time to get everything done:

It is always a scramble in five days to get through what we wanted. Our goal was to engage the teachers as learners, so they went through every step of the unit as learners to experience it. But as we got going, we realized teachers do not have common understanding of what inquiry is. They do not realize that part of inquiry is building a student explanation; it is not just asking questions and collecting data, it is how do you build an explanation? So we found ourselves spending a considerable amount of time getting teachers to the point of constructing an explanation for themselves so they would know what it felt like as a learner, to be a teacher of it later... Even though we tried, we had probably 4-5 different main focuses throughout the week, and we wished we had three weeks to go deeper into each of those.... We needed more time for teachers to reflect back on it and reenact it, so it was a trade-off with only doing only one week.

In order to support teachers who participated in summer institutes, project leaders envisioned school-year workshops as well as professional learning communities within districts and schools. Initially, three follow-up days were planned for the school year, but this was reduced to two as the project progressed. Project leaders reported that the follow-up sessions were less successful than the summer institutes. Ideally, the follow-up sessions would have occurred when teachers were teaching the units, but LAUSD had so many year-round schools that it was virtually impossible to schedule follow-up sessions to meet every teacher's availability. The scarcity of substitute teachers to cover teachers' classrooms while they attended these academic year sessions was also a barrier to teachers' attendance. Project leaders planned a series of Saturday follow-up sessions, but attendance was still poor. In short, the follow-up days were not well-integrated into the school curriculum because of the different school schedules. In the end, project leaders simply gave up trying to integrate them more fully.

Learning communities did develop in a few schools where principal support had resulted in a critical mass of teachers participating in SCALE-LA. For instance, teachers at a school where all science teachers had participated in the MSP institutes reported that the project had an impact on their school, creating common ground for discussion at department meetings. A teacher from another school, however, remarked that the project met her school's needs "at least for the teachers that attended." Thus, it appeared that any school-level support that occurred was at the initiative of individual schools rather than a result of project initiatives.

Plans for the creation of professional learning opportunities and support structures at both the district and school levels did not work out as intended because development and implementation of the immersion units consumed most of the available time, energy, and resources. A central office science supervisor lamented the fact that the initiative had not developed an infrastructure to provide support for classroom implementation.

Key Factors in the Implementation of SCALE-LA

Changing curriculum and instruction in a large urban district presents a considerable challenge, especially given the frequent turnover at all levels of the system. The SCALE work resulted in the development of immersion units and accompanying professional development for teachers on the implementation of those units. The scope of the SCALE work was large, reaching roughly 625 of the approximately 800 middle grades science teachers in LAUSD. Although the project did not fully transform science education in LAUSD—a monumental task in any system—there is evidence that the efforts made a difference. Following, we consider key factors of SCALE-LA.

- Developing district support was critical to the work.
- Creating a shared vision for science education reform was important to SCALE-LA’s work, but very time intensive.
- Investing heavily in efforts to develop capacity and infrastructure laid the groundwork for continued science education reform in LAUSD.

Developing district support was critical to the work.

As noted earlier in this report, it was initially assumed that support for SCALE-LA would come from the top down, given the close relationship between the Institute for Learning and the former LAUSD superintendent. When the Institute for Learning left the project, the SCALE liaisons to LAUSD initially worked primarily with teachers, but decided that they would not be able to scale up the project with this approach. Consequently, they adopted a “middle-out” strategy in which they worked through the district secondary science supervisor and middle level science experts, specialists, and advisors. These staff members were then able to “sell” the work at various levels within the system. A project leader explained:

We kind of got a jump start with this new group as to where we were going to go. So we got the buy-in at this middle level and the buy-in with [the science] director. So [the director] could say, “We are doing this in science,” and the middle level could go back to local districts and tell them this is what they were doing.... We started hearing from the [teachers’] union and from other areas that they wanted more of the science immersion stuff, not textbooks, and [the science director] said, “Thank you, that is what we are wanting to do.” We were starting to hear that other subject areas were interested in this model, so at that point in time it starts to become a little more political to support larger items.

Project leaders devoted less attention, however, to developing support among school principals. The initial assumption was that principals would be brought in through the Institute for Learning’s work with superintendents. By the time the Institute for Learning left the project, other project leaders were consumed with developing the immersion units and the corresponding professional development, and essentially “forgot about principals.” Principals were informed of the work, but it was left to participating teachers to sell the program to their principals—an approach that project leaders later regretted. They feared that as middle-level central office staff

changed, only the teachers who participated in SCALE-LA would remain to serve as a voice to continue MSP-like practices.

Creating a shared vision for science education reform was important to SCALE-LA’s work, but very time intensive.

Obtaining initial buy-in for the work was an important step, but SCALE-LA went further, making great strides in developing a shared vision of quality science instruction district-wide. They also developed the capacity to reform science education through the collaborative model of the Professional Development Study Group. A district science expert remarked,

In comparison to other initiatives I have seen, [the SCALE-LA] is the only one that has involved district leadership, and given us a product that was co-collaboration and development with all the partners.

The outcome was that a common vision developed within the district about what effective science instruction and quality professional development look like. A project leader from one of the universities reported hearing a new LAUSD science director describe a structure for professional development in the district that was similar to the SCALE-LA’s Professional Development Study Group. The director was not aware that the structure was developed through SCALE-LA, but project leaders were nevertheless gratified to see the work becoming institutionalized. In addition, two local districts within LAUSD that were involved with SCALE-LA combined efforts to obtain a grant to implement a structure similar to the Professional Development Study Group.

The vision of science education reform extended to changes in undergraduate science courses. Unlike science education faculty at the California State University institutions, faculty housed in the science departments had little history of involvement in K–12 science education or professional development efforts. Project leaders reported that the collaborative work to design the immersion units and design and implement the professional development had “an effect on undergraduate science education” and on science faculty members’ publication in the area of science education.

Investing heavily in efforts to develop capacity and infrastructure laid the groundwork for continued science education reform in LAUSD.

All partners in SCALE’s work recognized the critical role played by University of Wisconsin liaisons on a number of fronts. These liaisons worked intensively with district staff, teachers, and university faculty to develop immersion units and the corresponding professional development. In the process, they hoped to not only build capacity within the district to do this sort of work, but to also institutionalize a partnership between LAUSD and the California State University sites that would ensure ongoing external, content-focused support for the district’s work in science education reform.

During the immersion unit development phase, University of Wisconsin liaisons effectively lived half-time in LA to support the local experts in designing the units. This co-construction laid the foundation for translating the units into professional development on the units—a feat that would

have been impossible without the commitment and shared vision of California State University and LAUSD faculty.

The University of Wisconsin team was systematic in its approach to building the capacity of district and university personnel to lead the summer institutes. During the first year, project leaders co-facilitated the institutes with the local facilitation teams. They then identified a lead person to take over. The next year, the Wisconsin leaders mentored the lead facilitator for the first week of the institutes. In subsequent years, institutes were facilitated entirely by local teams. This process developed the capacity of a large number of LAUSD staff and university faculty to design and facilitate science professional development.

Likelihood of Lasting Impact

LAUSD has a history of science education reform, and SCALE-LA leaders used a number of strategies that will contribute to the sustainability of science education reform in the district—at least for the immediate future. The long-term sustainability of SCALE-LA’s work in LAUSD will be challenged by the nature of a large, urban school district—ongoing budget issues and a lack of institutional memory due to high personnel turnover.

Project leaders were frustrated that they simply did not have enough time to build an infrastructure that could support the work—although progress was made. They acknowledged that the level of effort required to develop immersion units and the corresponding professional development led to burnout, and also made it difficult to attend to other important components of the project, such as providing classroom support and engaging principals more fully. Following are insights, provided by SCALE-LA leaders and participants, regarding their hopes for the work beyond the funded period, as well as initial evidence of what will be sustained.

Developing a Core Science Instructional Program: Immersion Units and Professional Development

While a common vision for science education reform has begun to take hold in LAUSD, the issue remains of who will facilitate and perform the work. Developing the immersion units and subsequent professional development took an enormous amount of time, energy, and resources—as well as expert help from SCALE liaisons. There was concern that burnout had begun to occur even before grant funding ended, and a recognition that the district would be unable to maintain that level of activity over time. Said one project leader, “We worked 24-7 and it was not a business model; it was a what-needs-to-be-done-to-make-the-work-happen model.”

SCALE-LA’s work aligned well with LAUSD needs, which was essential to any prospects of sustainability. Developers of the immersion units made sure everything they developed was aligned to the California science standards, and that LAUSD officials had final say on the unit topics. As a result, the 6th grade Plate Tectonics unit—which was viewed as most strongly aligned with the districts’ science standards—may be adopted as part of the official curriculum. The materials for these immersion units could be ordered from LAUSD’s instructional materials warehouse, and even a couple of years after SCALE-LA funding ended, orders for the 6th and 8th grade immersion unit materials were still being placed.

The SCALE-LA funding came at a propitious time; just as the MSP award began, the district science director was creating a district science plan. In addition, the project was compatible with the district's "A-G For All" Resolution adopted midway through the MSP grant. This policy was designed to ensure that all students graduate from LAUSD college-prepared or career-ready by having access to 15 courses in the "A-G" curriculum, including a college-preparatory sequence that includes two years of "Lab Science." The district science director considered the immersion units an exemplary curriculum that embodied important elements of science education reform.

In addition to adopting the 6th grade immersion unit, the district planned to implement science "model lessons," a less comprehensive version of immersion units. Model lessons would be designed as 1–2 week learning experiences for students to focus on topics covered in the district's periodic assessments. The topics would be those on which students had scored poorly. Model lessons would cover a smaller portion of the curriculum than did SCALE-LA immersion units, but be more widely disseminated. All science teachers in the district would be asked to implement the model lessons, and would be provided with two days of professional development on their use. The plan was for professional development to be delivered by LAUSD district science experts and advisors, most of whom had participated in the SCALE-LA Professional Development Study Group.

In addition, the Professional Development Study Group approach has been adopted as a model for developing all science professional development in the district. These advances were accomplished, in large part, through the strategy of involving district staff, teachers, and higher education faculty in the work in such a way that a common vision of effective science instruction and effective professional development began to take hold in the district.

District Support

As the grant period was drawing to a close, LAUSD faced budget cuts of 25–35 percent, characterized by a district science leader who was fully supportive of SCALE-LA as "deep, draconian cuts in a system that can't take it, so we don't know what will be left." These budget reductions put a halt to all professional development in the district and many of the district-level positions were dissolved, resulting in the dispersal of the approximately 50 district-level science staff who had been involved in the SCALE work at either the middle and/or secondary level.

LAUSD's work with SCALE helped them procure state MSP funding. Through this funding, the district, CSU Dominguez Hills, and Cal State Northridge partnered to continue developing immersion units and professional development, although these efforts were limited to smaller numbers of teachers, far fewer than the approximately 625 served district-wide through SCALE. The district continued to follow the same development and implementation processes modeled by SCALE, and the incentives for participating, for district staff, faculty, and teachers, remained the same.

With a new superintendent, new policy initiatives may also affect the focus on science learning through immersion experiences. For instance, the district is implementing a learning team approach, which will require teachers to work across disciplines to meet the needs of individual students. There were reports that science teachers were already being pulled out of department

meetings to participate on cross-disciplinary teams. In addition, the new superintendent planned to decentralize, pushing professional development funds out to the local districts. SCALE-LA leaders were concerned that this decentralization would have a negative impact on the coherence that the project helped develop in science education.

There was concern, as well, that with only one person remaining at the LAUSD central office who was there when the SCALE-LA began, there would be too little institutional memory to build on the MSP work. Project leaders had made assumptions that district leaders would recognize the value of the work and be prepared to step in and take over. However, they did not take into account that some of the key leaders at the end of the project had not been involved in early planning of SCALE-LA's work and, therefore, did not realize that the project was shaped around district needs. Instead, these district leaders perceived, at least to some degree, that the district was being made to do this work by external entities.

SCALE-LA had planned to phase out their team's role in the district, gradually increasing the responsibility of the district to carry the load. The intensive work during the initiative, however, led to burnout of the SCALE-LA staff, which included LAUSD district personnel, and given the hectic pace as the project funding drew to a close, there was little time to plan for transition. There was fear that district leaders did not have sufficient ownership of the work and would not want to assume leadership as SCALE-LA funding ended. Said one project leader:

Assumptions were really being made on who is responsible for the work, why is this going in this direction, why are these summer institutes being run? What we lost was this institutional knowledge with science directors coming in and out. We in [the SCALE-LA] leadership did not recognize soon enough that we were not being explicit and open enough with everybody that we were backing away, and that it was their responsibility to make sure this transferred, and that [SCALE-LA] is a partnership with the district, and that many things we were doing were things the district asked for five years ago... So, we failed to do that home-run stretch, that last bit to say, "This is the district's work." For awhile we had that going, but as people turn over, how do you maintain coherence?

A K–12 and Higher Education Partnership

SCALE-LA made significant progress in facilitating partnerships between LAUSD and the California university system, in building capacity for science education reform, and in developing curriculum units that model inquiry-based science focused on conceptual development. At the same time, the difficulty of maintaining momentum in a large urban district with frequent turnover, competing priorities, and budget shortfalls was a concern for all partners who were integrally involved with the work.

As University of Wisconsin liaisons worked with the Professional Development Study Group to build capacity to offer professional development around science immersion units, they purposely sought to develop a closer partnership between LAUSD and the local California State Universities that could be sustained when the SCALE-LA grant ended. The strong role played by CSU Dominguez Hills evolved over time as SCALE leaders from University of Wisconsin and that institution saw the benefits of the partnership that was forming. CSU Dominguez Hills' role was initially envisioned as a modest one; the MSP proposal suggested that it was an example

of a local university that would consider, through its association with SCALE-LA, revising its approach to preparing teachers. Over time, however, that university came to play a “seminal, transformational role” in SCALE-LA (according to project documents), such that it became “the rule rather than the exception” that science faculty and science education faculty worked with LAUSD.

The partnership between LAUSD and the California State University sites did not develop fully enough to be sustained in the same form in which it operated during the SCALE-LA. Even so, a model was created that might be emulated for future work if leaders in LAUSD and the university system identify opportunities that would benefit from such a partnership. Project leaders had hoped that, as MSP funding ended, university faculty would take on the responsibility of facilitating the Professional Development Study Group. In fact, SCALE project leaders hoped to bring together California State University faculty from Northridge, Dominguez Hills, and Los Angeles to help them determine goals and directions for the work they would like to do with LAUSD, then facilitate a meeting with LAUSD leaders to determine how these needs and directions meshed with those of the school district. The next step would be to take these representatives from LAUSD and the universities through a one-year course similar to the Professional Development Study Group but focused on writing grants to meet the identified needs. Project leaders also worked at grooming a key district staff member as a “boundary crosser” to serve as the face of the project for both LAUSD and university partners.

Ultimately, the plans to develop this infrastructure were not fully realized because of “burnout and too many other things going on.” The work of developing immersion units, and then developing and offering professional development had been intensive and draining, and consumed much of project leaders’ time. In addition, the Professional Development Study Group did not get underway until the third year of SCALE-LA. There was a sense that project leaders simply did not have enough time to fully develop the K–12 and higher education partnership needed to keep the work moving forward.

Changes in Higher Education Institutions

Science faculty who were involved in the Professional Development Study Group reported that their participation had made them see the need to use better pedagogy in their science courses, including inquiry-based activities. In addition, a project leader noted that STEM faculty at the California State Universities maintained an interest in K-12 education, teacher preparation, and professional development that had not existed prior to SCALE. The immersion units themselves were used at both CSU Dominguez Hill and Cal State Northridge as part of their science education programs.

As a university-based project leader noted, such changes are a form of institutionalization:

We have had 30 math and science faculty working in [SCALE-LA], many of them in science, and they have changed the way they teach. Our science education people are using immersion units as part of their methods courses; [they] have changed how they teach in their own classrooms, being aware they are teaching future teachers in LAUSD. All of those things are institutionalization, and they are in for the long run because

universities don't change like school districts do; we get tenure and stay and continue to do our thing.

Additional Partners

Project leaders did not rely solely on university faculty to support science education reform in LAUSD. During the funded period, they used their connections with other external agencies to set up structures to continue the work when SCALE funding ended. For instance, University of Wisconsin leaders facilitated the development of a relationship between LAUSD and the Biological Science Curriculum Study Group to assist the district in developing the model science lessons.

The Department of Water and Power (DPW) had long supported science professional development in LAUSD, offering many “make-and-take” workshops for teachers. The secondary science director, wanting a more substantial partnership role with DPW, encouraged them to engage with the SCALE-LAUSD development work, particularly the work on the 6th grade Plate Tectonics immersion unit and professional development. DPW bought into SCALE-LA’s design framework and development model, excited at the prospect of reaching hundreds of teachers through curriculum development for the district and “just-in-time” professional development to accompany the units. DPW gave the district \$500,000 to support both a district science position, one of the few remaining after the budget cuts, and the development of immersion units and professional development for 11th and 12th grade topics, grade levels not targeted by the SCALE work.

Some district staff involved with the SCALE-LA Study Groups were concerned that this new work and its products would not be of the same caliber as that done under the MSP funding. Still, it was believed that external support of some sort was needed to ensure that the district continued to move forward.

Closing Thoughts

Working with a district plagued by high teacher turnover posed a considerable challenge to the work of SCALE-LA and its potential sustainability. SCALE-LA worked to integrate educative instructional materials into the district curriculum, a way in which to provide ongoing support to current teachers of middle school science and to the expected new science teachers. Capacity building of both district and school personnel as facilitators of professional development was also a high priority. The residue of SCALE-LA in LAUSD increased the capacity of the system—both LAUSD and the local universities—to tackle K–12 science education reform.