



**June 30, 2005**

---

System-wide Change for All Learners and Educators

**Third Annual Progress Report  
to the National Science Foundation**

The preparation of this report was supported by a grant from the National Science Foundation to the University of Wisconsin–Madison (EHR 0227016). At UW–Madison, the SCALE project is housed at the Wisconsin Center for Education Research. The other partners are the University of Pittsburgh, where the SCALE project is housed within the Learning Research and Development Center’s Institute for Learning; California State University Dominguez Hills; Los Angeles Unified School District; Denver Public School District; Providence Public School District; and Madison Metropolitan School District. Any opinions, findings, or conclusions are those of the author and do not necessarily reflect the view of the supporting agency.

## **2005 Third Annual Progress Report**

### **System-wide Change for All Learners and Educators**

Introduction.....	1
Goal 1: Core STEM Instruction System .....	2
Goal 2: STEM Immersion Units .....	10
Goal 3: Coherent IHE Participation and Professional Development.....	16
Goal 4: Equity .....	22
Goal 0: Management .....	28
Lessons Learned.....	30
Appendix 1: Quantitative Estimates of SCALE Influence on Teachers and Students .....	35
Appendix 2: Implementation Matrix .....	39
Appendix 3: Benchmark Matrix .....	56

## Introduction

Year 3 has been productive for the SCALE Partnership. We report here using the original SCALE Goal taxonomy. We do not include Goal 5; Research and Evaluation is reported on in a separate document. Throughout this progress report it should be apparent that the SCALE partnership is thriving and has accomplished a great deal. However, an important element not captured in the breakdown by Goal is the very nature of the partnership itself. We address this issue in an informal “phenomenological” manner because it is necessary to understanding the SCALE enterprise.

SCALE started with seven major institutions as partners, and most of the institutions had no relevant previous working relationships. The cultural differences among these institutions are remarkable, and even the cultural differences within each of these institutions across their complex components are remarkable. Despite this initial condition, SCALE has made great strides in creating meaningful connections among these institutions and their many different levels. This is one of the most significant accomplishments to date—adding substance and definition to what started as a nominal partnership with only vision and good will in common.

There are many challenges that have been addressed to accomplish this. A primary problem is what might be called “impedance matching.”<sup>1</sup> The logics, rhythms, and forces that drive the different institutions and their component parts constitute centripetal forces with respect to the partnership. It is through careful “impedance matching”—for example, translating planned actions into mutually accessible language that respects critical features of participating social networks—that related challenges are addressed. The SCALE partnership has been fortunate to date that the centrifugal forces of good will, trust, common goals, and careful planning have managed to minimize the effects of these differences.

---

<sup>1</sup> Electrical circuits are characterized by such quantities as resistance, capacitance, and inductance. Alternating currents interact in complex ways with such circuits, and a combined measure used to help predict those interactions is “impedance.” When it is desirable to have the maximum amount of power transferred between two such circuits, one must attempt to match the impedances of the two circuits. By analogy, we will say that to maximize the information exchange and organizational transfer among different institutions, one must attend to matching impedances.

## **Goal 1: Core STEM Instruction System**

In the original SCALE proposal, the stated focus of Goal 1 was to “implement strategies to transform core STEM teaching system-wide... so that every student experiences deep, conceptually based instruction on core math and science concepts on a continuing basis.”

To organize this work, we identified four dimensions of the instructional system in a district: a) the core teaching system in each subject area; b) professional development of school administrators and teachers; c) monitoring; and d) assessment. Along these dimensions, the focus of the Goal 1 work through the Institute for Learning (IFL) over the past years has been to coach and mentor DPS, LAUSD and PPSD to improve their instructional systems in mathematics and science. In each of the SCALE IFL districts, the IFL had long-term relationships and had begun work that SCALE was able to build upon. Pre-existing IFL contracts with each of these districts provide the basis for this leveraging strategy. Each district uses its limited contract capital funds for the basic partnership and a small set of specific services. SCALE has allowed the IFL to greatly enlarge and intensify both the specific services for and the general consultation to each of these districts in mathematics and science.

The IFL provides SCALE districts with comprehensive coaching, mentoring, support, and materials in the service of the larger goal of SCALE. They have a small number of traditional “formal” PD events. These include PD sessions for principals, coaches and teachers; planning meetings for intermediaries; and stocktaking sessions for district leaders. They spend a larger proportion of time consulting with, discussing, coaching, and mentoring district personnel.

MMSD is no longer an affiliate member of IFL. Consequently, the IFL plays less of a direct role in the implementation of Goal 1 strategies in the district. However, MMSD continues to work on the objectives and benchmarks of Goal 1 in collaboration with the SCALE partnership. In Years 1 and 2, the district received training in the Principles of Learning and Disciplinary Literacy (DL) and continues to incorporate these strategies in their efforts in mathematics and science.

As the attached Benchmark Matrix (Appendix 3) indicates, the following Goal 1 benchmarks from the 5-Year Strategic Plan have been met: 1a-1, 1a-2, 1a-3, 1a-5, 1a-6, 1b-1, 1b-2, 2a-1, 2a-3, 2a-4, 2b-1, 2b-2, 2c-1, 2c-2, 2c-3, 2d-1, 2d-2, 2e-1, 2e-2, 2e-3, 2e-4, 3a, 3b-1, 3b-2, 3d-1, 4a, 4b-1, 4e-1, and 4e-2. The following benchmarks are on schedule to be met by December 2005: 1a-4, 1a-7, 2a-2, 2a-3 (and each year thereafter), 3d-2, 4c-1, and 4d-1. Similarly, the following are on schedule to be met by December 2006: 2d-3, 3b-3, 3c-3, and 4e-3. The following are on schedule to be met by times beyond December 2006: 1a-9, 2d-4, 3c-4, 3c-5, 3d-3, 4d-2, 4d-3, and 4e-4.

SCALE met or exceeded expectations set out in the Year 3 Implementation Plan for the following activities in Goal 1: District Planning and Implementation; Professional Development; Rubric Development; IFL Events, DL Institutes, and In-district Work; Incorporating Rubrics into Districts’ Professional Learning Systems; Introducing Two New Topics at the Middle School Level through Disciplinary Literacy; Interim Monitoring of Mathematics and Science Instruction; Monitoring Accountability

Measures to Project Student Proficiency Increase; and Implementing Periodic Assessments. Two activities from the Year 3 Implementation Plan for Goal 1 were modified: 1) the responsibility for IHE conferences was moved to Goal 3; and 2) the scope of the curriculum advisory group changed to focus on identifying mathematics and science specialty schools serving a diverse student body and to document their progress. Beginning in Year 4, SCALE/IFL will refocus the collection of video examples of mathematics and science teaching in SCALE districts.

### **Denver Public Schools (DPS)**

Since DPS had selected an elementary mathematics program and had begun implementation of it before SCALE was funded, they chose to focus SCALE resources on middle and high school mathematics and science and to coordinate the work in these two content areas with a systemic approach to the building of a coherent instructional program. The district chose to use the IFL Disciplinary Literacy System as a central organizing structure for both understanding what rigorous instruction in each content area looks like and to form the basis of a common framework across four subject areas. DPS laid out a coherent sequence for consistent district-wide implementation in mathematics. They adopted Every Day Math in elementary school, Connected Math in middle school, and the sequence of Cognitive Tutor, Geometry, and Advanced Algebra in high school. The Geometry program was piloted this year and the Advanced Algebra curriculum will be piloted next year. The district's intention is to develop a coherent set of PD systems to support the mathematics program.

In mathematics, DPS sent a group of mathematics experts to the national Disciplinary Literacy Institutes for training. This group, in turn, provided Disciplinary Literacy Institutes to a larger group of middle and high school teacher leaders. This larger group includes three mathematics and three science teachers from each school of 30 high school mathematics teachers and 60 middle school teachers who attended monthly professional development sessions in the district. These teacher leaders formed the core team of mathematics coaches. This approach to developing the teams represents a very dense engagement of teachers in this work. Almost 25% of all middle and high school teachers have been engaged in this work and report ownership in it. Using this strategy of engaging large numbers of teachers in this way is intended to solve the problem of teacher buy-in that many new programs have.

DPS's goal in science, like mathematics, was to design a system to support consistent coherent instructional programs. The district's planned science sequence is as follows: elementary school science, TRACS (piloted in 2004-2005); middle school science (to be field tested in 2005-2006); and high school Biology (to be implemented in 2005-2006), Chemistry (to be developed in 2006), and Physics (to be developed in 2006). IFL staff advised and coached the district through this review and decision-making process.

For example, in the spring of 2004, the SCALE/IFL team helped lead DPS through the Assessing Instructional Materials (AIM) process developed by the Biological Sciences Curriculum Study (BSCS) to analyze instructional materials in biology. The goal was to select a high quality, standards-based, rigorous, inquiry-oriented instructional program for district-wide implementation in tenth grade. The group subsequently selected *Biology: A Human Approach* (AHA) as the district-wide Biology program. That summer, the district provided PD for one teacher in each high school. During the 2004-2005

school year, the science group developed “big ideas” of biology consonant with the adopted program, the pacing guide and the Status of the Class documents to guide teachers’ use of data on students’ understanding of key concepts in biology.

Science used the same plan as mathematics. A core group of experts being trained at the national Disciplinary Literacy Institutes will train a larger group of coaches back in the district. In science, the initial use of Disciplinary Literacy served to increase the teacher leaders’ understanding of scientific inquiry, to introduce them to research on cognition, and to familiarize them with the big ideas in the discipline. SCALE/IFL staff provided on-site assistance for the core team, coaching them to develop a process and to use a set of tools to analyze a variety of high quality instructional materials in Biology. The field test teachers presented the new program plans to all biology teachers in a district-wide meeting.

### **Los Angeles Unified School District (LAUSD)**

In LAUSD, the influence of SCALE builds on the more than five years of IFL contractual work with the district. SCALE’s ability to have an impact in a district as large as LAUSD is mediated by the larger, contractual work of the IFL. One result of this long-term relationship was the decision to have Goal 1 resources focused on the mathematics work of the lead SCALE/IFL liaison with LAUSD. SCALE has already contributed substantially to science in LAUSD in work that will be described in the Goal 2 and Goal 3 sections.

In December 2003, SCALE/IFL began a series of two-day planning sessions focused on assessing mathematics issues and needs, and continuing the work toward the establishing rigorous, systemic K-12 mathematics program. The first of these sessions, which was led by Lauren Resnick in collaboration with LAUSD leaders and SCALE partners, focused on the low performance of middle school students on interim mathematics assessments in quarters 1 and 2 of 2003-2004. The IFL liaison to LAUSD began focusing the monthly leadership work in each district with local district Superintendents, Directors, and Principal Partner study teams on the systemic improvement of mathematics. SCALE/IFL designed two 3-hour modules in collaboration with the LAUSD District Fellows and based on IFL mathematics sessions that had been used with coaches in the system.

In July of 2004 the LAUSD central office asked SCALE/IFL to focus support on Program Improvement Middle Schools. Following the planning session, SCALE/IFL worked with district mathematics leaders to develop a Proposed Middle School Math Plan for Program Improvement Schools. SCALE/IFL presented the plan to the Central and Local District Superintendents in August 2004, providing LAUSD with an opportunity to apply across the system the leadership work that the SCALE/IFL had provided to the districts over three years.

SCALE has also worked with LAUSD on their monitoring and accountability systems. Andy Porter reviewed the mathematics periodic assessment system in light of the low level of performances in the district and the results of a case study of mathematics teachers and coaches jointly conducted by SCALE and LAUSD researchers. The IFL, with SCALE support, and LAUSD are also working on aligning interim assessments with key mathematical concepts for each quarter at three grade levels. This alignment of curriculum and assessment will serve to provide more usable data about the effectiveness

of the new instructional guides and the professional development in improving student achievement. In the next several weeks, LAUSD, with our guidance, expects to contract with a testing company for a new assessment, which will be substantially based on recommendations from Porter's report.

### **Providence Public School District (PPSD)**

In its SCALE work, PPCSD has focused on mathematics at all grade levels and has begun to look at a science sequence for the high school. SCALE/IFL focused the work on coaching and mentoring to create a system that integrates all the instructional dimensions into a coherent whole.

In the past year, the IFL with SCALE support worked closely with the Chief Academic Officer and the Chief of Administration (now the Transitional Superintendent) to identify discrepancies and to coach the district in its efforts to optimize system coherence. These efforts focused specifically on mathematics at the classroom, principal, curricular, and leadership levels.

SCALE/IFL convened three sessions in December 2004, and February and May 2005 to help PPCSD principals understand and support Disciplinary Literacy in their schools. Subsequent visits were made to schools to help the principals and others connect theory with practice. At the high school level, SCALE/IFL coached district leaders in developing a mathematics and science sequence. In addition to integrating curriculum from middle school to high school, SCALE/IFL addressed the development of an organizational system to facilitate implementation of revised district-wide mathematics and science curricula in high school classrooms. SCALE/IFL coordinated a visit of PPCSD leadership to Denver for a meeting with DPS's Chief Academic Officer (CAO) and content leaders to discuss DPS's recent implementation of new curricula. Providence leaders saw the need for system-wide coherence as they learned about the ways in which DPS not only organized for implementation at an administrative, procedural level, but also how they built teacher support for the curriculum by involving teachers at an early stage.

In addition to this direct coaching and mentoring, SCALE/IFL also often stressed the importance of having the right people in decision-making positions in each of the content areas. The IFL maintains a close working relationship with district leadership, regularly communicating in person, on the phone, and by e-mail. This relationship has allowed SCALE/IFL to build a great deal of trust in the district, where leadership continues to both seek and accept coaching from SCALE/IFL.

In PPCSD, SCALE/IFL work helped the district recognize the need for consistent professional development, create additional time to fill the needs, and provide coherent professional development in the newly available time. Based, in part, on the continuing discussions with SCALE/IFL about the need for more consistent learning opportunities for teachers, the district was successful in negotiating teachers' contracts for increased professional development opportunities, including times devoted to mathematics. As a result of the new contract, nine mathematics professional development sessions were added to the calendar: two full-day sessions and seven after-school sessions throughout the school year. SCALE/IFL was instrumental in designing and assisting the district in enacting these changes.

As part of the district's SCALE support, SCALE/IFL staff worked with PPSD to develop a case study in mathematics in one middle school. The case helped the district reflect on many aspects of the district's professional development model, surfacing a number of issues that will be the focus of the next phase of professional development:

- Creating greater knowledge among principals of the district's professional development model or teachers' courses of study.
- Creating a system to help schools create coherence among the district's nine professional development sessions and the schools' six.
- Assisting principals and coaches to develop the content expertise to design school-level professional development systems and lead school-level sessions that cohere with district-level professional development.
- Providing mathematics coaches to every school.

Three monitoring systems in mathematics currently exist in the PPSD schools:

- quarterly assessments, centrally designed, administered, and scored;
- students' mathematics journals that are based on the questions identified in the scope and sequence; and
- LearningWalk feedback.

As part of the case study described above, SCALE/IFL helped the school link quarterly assessment data, journal reflections, and the LearningWalk process, and use the data to assess instruction and to provide the teachers' with an opportunity to learn about mathematical reasoning.

### **Madison Metropolitan School District (MMSD)**

MMSD has articulated a long-range strategic plan that has led to the development of organizational policies and processes that are intended to lend coherence to the district systems. In concert with these efforts, the district is working to improve mathematics and science education at all levels by tightening the alignment between standards, curriculum, instructional practices, assessments, and professional development. The SCALE partnership is contributing to this work through its interactions with the district's Teaching and Learning Department which has major responsibility for the four main dimensions of Goal 1 (the core teaching system in each subject area; professional development; monitoring; and assessment).

SCALE resources and influence have been evident within the initiatives of the Teaching and Learning department. The influence of the SCALE/IFL is clearly visible in the MMSD educational framework. The framework documentation outlines how educators in the district will work to improve students' engagement, learning, and relationships. The language used contains prominent reference to IFL's Principles of Learning: Organizing for Effort, Socializing Intelligence, and Academic Rigor in a Thinking Curriculum. During the year that MMSD was an affiliate member of IFL, several district-level staff participated in professional development sessions conducted by the IFL. Since that time, district staff, including the mathematics and science specialists, has liberally incorporated the Principles of Learning into the professional development that they are providing to teachers and principals. This provides school level staff with consistent messages about the overarching instructional value system of the district and a coherent set of

professional development objectives that are shaping instructional guidance in the district.

SCALE is playing a major role in helping systematize the connections between the mathematics and science staff in the district and STEM faculty at the University of Wisconsin-Madison. This level of coordination represents a significant new development in the relationship between these entities. For example, SCALE has played a major role in helping the district rollout its 'Math Masters' project, described in more detail in the Madison section of Goal 3 below.

MMSD has used SCALE monies to fund the salaries of two Instructional Resource Teachers (IRTs). From the district's perspective, these positions represent perhaps the most significant SCALE impact. One position, a middle school mathematics Instructional Resource Teacher, will double the capacity of the district to provide professional development to teachers using the Connected Math Program. This allows district staff to work more closely with middle schools learning coordinators, teachers, and grade level teams and to customize their support to the particular needs of the school. The second position—a secondary science Instructional Resource Teacher—will also double the capacity of the science staff to work directly with teachers and principals at the school level to improve science teaching and learning. Here, professional development support has been directed at strengthening the implementation of the FOSS curriculum, helping teachers build their science content knowledge, and building the professional learning communities within science departments at the high school level. Together, these SCALE resources are helping the district address the continuing challenge of providing sustained support to teachers in implementing rigorous inquiry-based curricula.

MMSD has made use of a key SCALE tool: Surveys of Enacted Curriculum (SEC). In order to evaluate the implementation of the CMP curriculum, the district used the teacher surveys to assess the instructional practices of teachers of middle school mathematics teachers. The district's science program used the SEC tool to look at the alignment between FOSS, the Wisconsin standards, and the state assessments. SCALE staff provided technical assistance to the district in using the tool and interpreting the results.

Also, the SCALE Research and Evaluation Team developed and analyzed a survey that was distributed to all elementary teachers in the district as well as to all middle school science teachers. This survey provided the district with its first broad look at science teachers' instructional practices, their use of the FOSS curriculum, and their professional development needs. Findings from the survey are informing the work of the district science coordinator and the science IRTs, and will be used to build understanding of and support for the science program among other district administrators, the Board of Education, as well as school leaders.

SCALE partners from the University of Wisconsin-Madison participated actively in the district's K-8 science Scope and Sequence Review Committee. SCALE Research and Evaluation Team members facilitated discussions of Wisconsin Knowledge and Concepts Examination (WKCE) data, the science survey, and promising professional development practices. SCALE staff from the UW Center for Biology Education provided valuable insights into science inquiry and on-going professional development efforts with teachers and schools.

Finally, the SCALE Immersion Design Team has provided MMSD science staff and teachers with ongoing assistance in the development of multiple immersion units.

### **SCALE Rubrics**

#### *School Leadership Rubrics*

Since September 2004, we have been collaborating with Professor Richard Halverson from the University of Wisconsin–Madison to develop the School Leadership rubrics. These rubrics were designed to help local school leaders by using indicators first to measure whether the conditions for improving teaching and learning are in place, and second, to understand their own practice, especially around structures that establish school change and point toward potential paths for action. The School Leadership rubrics include five key components: (1) Focus on Learning; (2) Monitoring Teaching and Learning; (3) Building Nested Learning Communities; (4) Acquiring and Allocating Resources; and (5) Maintaining Safe Learning Environments. We use an ongoing IFL National Principals Think Tank, supported by the Wallace Foundation, as a test group for the School Leadership Rubrics as they go through successive revisions.

#### *Teaching Quality Rubrics*

Rubrics are currently being developed for assessing the quality of mathematics instruction in K-12 schools. Based on the Instructional Quality Assessment (IQA) toolkit, the current teaching quality rubrics are comprised of rating scales for observed lessons and classroom assignments with samples of student work. In addition, a rater training program has been developed comprised of a detailed manual with transcripts, samples of assignments and student work, and video clips to illustrate the different scale-points of the rubrics. The teaching quality rubrics were piloted in middle schools this past year in one of the SCALE districts (Providence). Paul Cobb and his research team at Vanderbilt University reviewed the teacher quality rubrics, and revisions were made based on their feedback.

#### *Professional Learning Rubrics*

Finally, the IFL is in the process of reformatting and expanding upon the Professional Learning rubrics, which were developed and introduced in the spring of 2004. The revised format will build on the successful model of the School Leadership rubrics, following a similar organizational structure. Expanding upon the existing Professional Learning tool with additional dimensions, the revised tool will be submitted in summer 2005 for review by the original rubric committee. Following revisions based on the committee's comments, the IFL will field test the Professional Learning rubrics in the fall with selected coaches and lead teachers from one or two SCALE districts.

### **Curriculum Advisory Commission**

In Year 3, Goal 1 convened a small group of science, mathematics, and curriculum experts to create guidelines that would assist districts in the adoption of their intended high school requirements. The focus was on recommendations of intellectually rigorous high school mathematics and science curriculum based on a high core content minimum. These recommendations included a science memorandum that covered two topics: (1) Key Principles that govern the Grades 9-12 science curriculum and (2) Recommended Sequences of Science Courses. The commission also produced a paper describing the concept of a “major” or “concentration” in mathematics.

It was determined in Year 3 that the commission should focus its efforts on identifying mathematics and science specialty schools serving a diverse student body and document progress in those schools. The group is now working to prepare a document suitable for use by districts to assist in strengthening their high school mathematics and science programs.

## **Goal 2: STEM Immersion Units**

The overall objectives for the Goal 2 Science Immersion Design Team (IDT) going into Year 3 were:

- To design and provide high-quality professional development for science immersion units for teachers in SCALE districts (elementary, middle and high school).
- To evaluate student learning from science immersion units.
- To continue to identify, develop, field-test and revise immersion units.

In order to meet the science objectives in Year 3, the Goal 2 Science Immersion Design Team has continued to coordinate its efforts with relevant work in the other SCALE goals, with existing district initiatives and by working to develop new district initiatives. The IDT has closely collaborated with the Research and Evaluation Team (RET) to measure the impact of Goal 2 work as it is integrated into SCALE districts. The IDT has worked closely with the reconfigured Goal 3 Team to bring significantly greater STEM faculty and IHE participation into the Goal 2 work.

As the attached Benchmark Matrix (Appendix 3) indicates, the following Goal 2 benchmarks from the 5 Year Strategic Plan have been met: 5a-1, 5a-2, 5b-1, 5b-2, 5c-1, 5c-2, and 5c-3. The benchmarks 6a-1, 6a-2, 6a-3, 6a-4, 6a-5, 6a-6, 6a-7, and 7a-1 have not been met except in MMSD and LAUSD. DPS and PPSD have changed the priorities of meeting the benchmarks because of transitions in senior personnel. These benchmarks will be re-evaluated in 2005-2006.

SCALE met or exceeded expectations set out in the Year 3 Implementation plan with the activities listed in the Goal 2 Activities Matrix (Appendix 2). These activities listed by major category show the flow of the science immersion work during Year 3. The primary Goal 2 work in Year 3 has occurred in Los Angeles, Madison, and Pittsburgh.

### **Integration of Science Immersion and Disciplinary Literacy**

The Science IDT has worked throughout the year to further integrate their work with the IFL's DL science program. In addition, the Immersion teams have made an effort to tap national expertise relevant to immersion design, development and professional learning. For example, in June 2004 there was training for all SCALE immersion unit writers and developers by Biological Sciences Curriculum Study (BSCS) director and staff. This training assisted in forming the foundation for immersion unit inquiry-based curriculum development and provided a key collaboration with other NSF-funded programs. As another example, the BSCS Associate Director facilitated a Goal 1 and Goal 2 Immersion Unit Development Teams' Institute in September 2004. The outcomes of this meeting allowed for building a more coherent notion of immersion and how it is supported by the research around how students learn.

In September 2004 there was a two-day meeting that highlighted the development of the immersion units and the alignment with the Disciplinary Literacy work at the IFL. Based on the outcomes of this meeting a more coherent plan of action for Goal 2 in the SCALE districts was developed. This led to the incorporation of Science Immersion into two IFL/SCALE National Disciplinary Literacy Institutes, one in October 2004 and the other

in January 2005. The science portions of these institutes were designed to provide the four SCALE districts (and other IFL districts) with a foundation for DL science and immersion along with specific strategies and tools for professional development session back in their districts in order to continue to build capacity. In addition, lessons from Immersion Units were used in DL science in-district professional development service.

### **Los Angeles Unified School District (LAUSD)**

One of the most significant achievements of Goals 2 and 3 during Year 3 was developing in the Los Angeles basin an emergent, robust partnership among groups that historically were not known for this kind of partnership. LAUSD leaders and California State University Dominguez Hills (CSUDH) leaders were among the leaders of this effort, with support from other SCALE staff. District science directors, district-level science leaders, local district-level science experts, STEM and education faculty from three California State Universities, and other SCALE staff have joined together in a unique regional partnership to co-plan, co-develop, co-implement, and co-evaluate immersion units for the LAUSD Instructional Guides. These teams will also plan, develop, and deliver the associated professional learning of teacher leaders and teachers. The leadership team also collaborated in writing a successful \$4.9M Department of Education TQE award called Quality Educator Development (QED) that is in close alignment with the SCALE work.

Goal 1 and Goal 2 SCALE staff, along with faculty from CSUDH, presented to the LAUSD science leadership three potential directions for immersion units based on the areas of need LAUSD identified. An outcome of this meeting was the development of two Immersion unit development teams that include representatives from the LAUSD science team, STEM faculty from CSUDH and California State University Northridge (CSUN), education faculty from CSUDH, and SCALE/QED supported curriculum writers. These development teams then met at least every other week (January–June 2005) to develop the immersion unit. This work was supported and future work planned by weekly teleconference among the key SCALE, QED, and LAUSD players. In December 2004, SCALE worked with the science leadership in LAUSD to outline the next year of immersion unit development and trainings for Grades 4-8. An outcome of this meeting was setting up immersion unit updates with the LAUSD elementary and secondary science leadership at their monthly meetings.

The SCALE/QED Immersion overview and kickoff meeting in January 2005 set the stage for the partnership between the CSUDH, LAUSD and SCALE around immersion unit development under the QED grant. Immersion units were showcased and the development protocols were presented. An outcome of this meeting was to establish bi-weekly meetings at CSUDH to co-construct two immersion units for LAUSD and to provide professional development for the STEM and education faculty around curriculum development, professional development for teachers, and assessment and teaching strategies supporting their work within their pre-service classes and in-service district professional development.

The Goal 2 leadership met with the Research and Evaluation Team (RET) members to identify the targeted needs of the immersion unit development teams as well as to begin to outline potential targeted studies around the professional development, implementation, and student achievement. In April 2005 four LAUSD teacher focus groups were held to elicit feedback on the professional development, implementation and

district support of immersion units. Both immersion implementers and non-implementers sessions were held. This feedback informed the revision of two field-tested immersion units and the planning for two subsequent institutes in May 2005.

The summer institutes will be facilitated by a collaborative group, including representatives of the immersion unit development teams from CSUDH, CSUN, LAUSD, and UW-Madison. There will be two Grade 6 institutes, one Grade 7 institute and one Grade 8 institute for classroom teachers, in addition to three Grade 4 institutes to develop a cadre of future professional development facilitators. These facilitators will work with all the LAUSD Grade 4 teachers in the 2006–2007 school year. In addition, two UW-Madison Goal 2 leaders, an IFL Disciplinary Literacy fellow, and an LAUSD SCALE science leader collaboratively facilitated a LAUSD Science Leadership Institute in May 2005. The Institute brought together all of the LAUSD K-12 science leadership (approximately 35 participants) under Goals 1 and 2 for a common experience and vision for science in the district. This was the first of three institutes planned for this team.

SCALE also has conducted a substantial number of Instructional Guides/Immersion Unit trainings in Year 3. For example:

- **July 2004:** These workshops were the first immersion unit professional development opportunities identified under the LAUSD science instructional guides. Approximately 30 Grade 7 teachers, 80 Grade 4 teachers, and 30 Grade 5 teachers were introduced to grade-appropriate Immersion Units in 2-day sessions facilitated by UW-Madison Goal 2 staff.
- **December 2004:** Under the California Math Science Partnership grant awarded to LAUSD, instruction on immersion units was provided to approximately 50 grade 3 and 12 Grade 7 teachers. This training experience provided the development teams with additional field-testing documentation for revisions and extended to classroom visitation for the units as they were implemented.
- **February 2005:** Grade 4 and Grade 5 immersion unit workshops were facilitated by UW-Madison Goal 2 staff for approximately 30 Science Lead Teachers in LAUSD Local District 1. The Grade 4 was to be a continuation of the field test for the unit and Grade 5 was presented for the first time to initiate field-testing.
- **February 2005:** Thirty-five Grade 7 teachers were introduced to the Grade 7 immersion unit, and this 2-day retreat included a formal field-test component for participants to take part in an LAUSD study of the implementation of immersion units in the district and the implications of immersion units on student understanding. This training was facilitated by SCALE Goal 2 leaders along with LAUSD science leadership.
- **March 2005:** Approximately 100 teachers in Grades 4 and 5 received immersion unit professional development facilitated by UW-Madison Goal 2 staff. This training was organized by the local district as a potential model for rolling-out the professional development needed and providing continued support back at the school site by the Science Lead teachers who were trained in February.

#### **Madison Metropolitan School District (MMSD)**

The MMSD Science Immersion Unit Planning held a meeting in August 2004. MMSD science leadership established a 2004–2005 school year immersion unit development and PD timeline with input from UW-Madison Goal 2 leadership for Grade 4, Grade 7, and

Kindergarten. Outcomes of this meeting included the formation of immersion unit development teams for each unit with representatives from district science leadership and teachers, a SCALE writer, and STEM faculty as reviewers of materials. During the months of July and August 2004, an immersion unit development team met every other week to co-construct an immersion unit to meet the districts needs in Grade 7 Earth History. This team included SCALE-funded writers, district science leadership, STEM faculty from the UW Geology Museum, and graduate students. In October 2004 a one-day immersion unit training was held to establish a field test group for the Grade 7 unit on Plate Tectonics. This training was co-presented by UW faculty, district leadership, and SCALE developers.

In March 2005, approximately 20 teachers participated in professional development facilitated by UW-Madison Goal 2 staff on the newly co-constructed Grade 4 immersion unit for spring 2005 field-testing. Building off of other NSF-funded materials, this Grade 4 immersion unit was developed in connection with the Full Option Science System (FOSS) unit currently being used in the district. Outcomes of this institute led to classroom observations and implementation studies under Goal 5. In May 2005, approximately 20 teachers participated in professional development on the newly co-constructed Kindergarten immersion unit for field-testing spring 2005. A collaborative team of UW-Madison Goal 2 staff members, MMSD leadership, and MMSD Kindergarten teachers planned and facilitated that first-ever Kindergarten science inquiry professional development event. Outcomes of this Institute led to classroom observations and implementation studies under Goal 5.

In April 2005, the last of six MMSD Scope and Sequence Review Committee meetings were held to revise the MMSD K-8 Scope and Sequence. Representatives from the IDT worked with the district teachers and leadership on the committee to provide additional support and to integrate the concept of immersion into the planning. In June 2005, MMSD science leadership and Goal 2 leadership met to plan Immersion Unit professional development and implementation through 2007. The goal of this plan is to structure yearly professional development such that by the 2006-2007 school year there are immersion units being implemented and supported at every grade level (K-8 and two in High School).

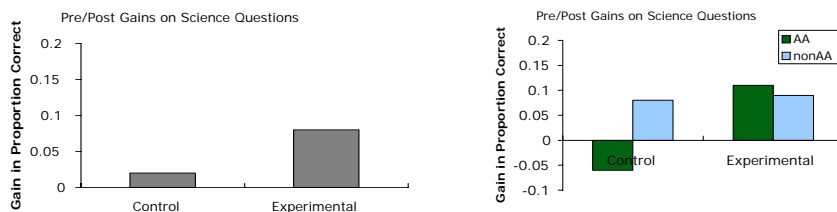
### **University of Pittsburgh**

Chris Schunn and his research group developed and tested science immersion units based on the concept of the design cycle. The tests were carried out in Pittsburgh Public Schools with very positive results. For example, his group developed a designed-based immersion unit called “Design an Alarm System” that was inserted into the Electronics FOSS unit as a partial replacement. The unit was intended for 4-5 weeks of instruction, and it covered relevant physics concepts such as voltage, resistance, current, series circuits, parallel circuits, etc. The team designed and produced the materials, and wrote a Teacher Guide and provided a series of PD workshops on the unit.

Schunn’s group researched the implementation of this unit in Pittsburgh Public Schools Grade 8 classrooms. The experimental group has 10 schools, 10 teachers, 26 classes, and 587 students. The matched control group had 5 schools, 5 teachers, 20 classes and 466 students. Although the students in the experimental group performed better on various measures than did students in the control group, the effect was more pronounced for

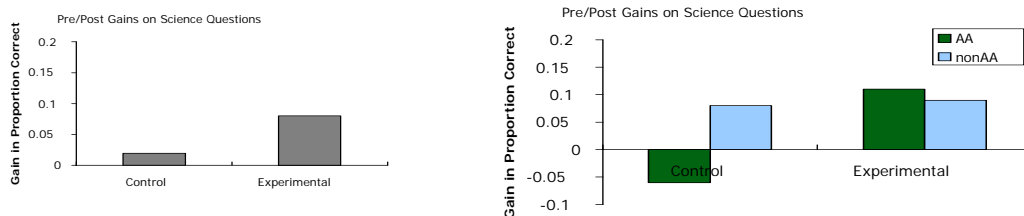
African-American students than for non-African-American students. As the two graphs below indicate, the results are very encouraging about the impact of the immersion unit both on student learning and on the equity gap.

## Early Results Performance & Equity



Equity Gap Eliminated with Immersion Project

## Early Results Performance & Equity



Greater gains with Immersion Project by AA students produces 70% reduction in Equity Gap

**Figure 1 and 2. Early Results Performance and Equity with Immersion Project**

Year 3 saw the development of three new research and development efforts. The first was an action research project that looked at the requirements for system-wide adoption of an immersion unit in an urban district. Pittsburgh Public Schools implemented the Grade 8 Alarm Systems Unit as a core part of its adopted science curriculum. The study focused on identifying what would be required to have all 30 Grade 8 science teachers in the district use the unit. Preliminary analysis reveals that between 75 and 80 percent of the teachers implemented the full immersion unit, which is a high penetration rate for an urban district with a large variety of atypical school situations. These data are still being collected and will be analyzed through the remainder of Year 3. Further, the students in the 2<sup>nd</sup> cohort classes seemed to be as engaged as the students observed the year before, and teachers implementing the unit for the second time appeared to be able to bring students to higher levels of performance. Quantitative analyses of classroom observations, student portfolios, and paper tests will be conducted to test these initial impressions.

In April 2005, the University of Pittsburgh group came to Madison to present to an overview of the Alarm Systems Unit and implementation results to UW-Madison faculty and students and to Madison Metropolitan School District Grade 8 teachers. The reaction of the teachers was favorable and a majority of them plan to participate in a three-day workshop in late July 2005, with the idea of implementing the Alarm System Unit in MMSD in the Fall of 2005. The research group will again be interested in what factors influence the widespread adoption of the unit in an urban district.

A second research project saw the modification of the assessment methodology used in the Alarm System Unit. The first deployment of the unit focused on portfolio assessment as a formative/summative assessment for classroom use, and pencil-and-paper assessment and independent observation for research assessment. However, researchers found this implementation did not meet the teacher's need for focused feedback on student's conceptual development, nor did it meet the researcher's needs. A revised assessment approach was created for the second deployment, incorporating rich embedded assessments that teachers felt comfortable using for summative assessment; the revision also addressed key concepts of interest to the researchers. The physics misconceptions research literature was very influential in the design of these tests.

A third research project related to the development of a new immersion unit for teaching Force and Motion concepts in LAUSD and in Pittsburgh Public Schools. This unit used the design-based learning approach of the Alarm Systems Unit, but targeted concepts of kinematics and Newton's laws. The research project around this unit sought to exploit the opportunity created by the research study of the year before. In particular, approximately a third of the Grade 9 students in Pittsburgh Public Schools had received the Alarm Systems Unit the year before, and this student sample was well distributed by gender, ethnicity, SES, and region throughout the district. At the same time, with the transition from middle schools to high schools and with the arbitrariness of school feeder-system boundaries, most Grade 9 science classrooms had a good mixture of students who either had or had not participated in the Alarm Systems Unit. Thus, we could examine whether immersion units are powerful enough to see carryover effects from one year to the next. Effects will be analyzed later in Year 3.

### Goal 3: Coherent IHE Participation and Professional Development

As of June 2005, Goal 3 Tracks 1 and 2 had accomplished the key objectives that were initially focused at the University of Pittsburgh. These Tracks have now been eliminated, and the focus for Goal 3 has now returned much closer to the vision of Goal 3 in the original proposal:

...However, waiting until teachers are already in the workforce and then, in effect, *retraining* them is inefficient. Why not begin the process of professional learning that we will develop under SCALE's auspices during teachers' *preservice* preparation and then continue with the kind of content-focused coaching program described above throughout the teachers' careers, with special intensity during the first 2 or 3 years of induction into the profession?

The key to such a career-spanning professional learning system lies in tight links between the major teacher preparation institutions in a region and the districts into which they send most of their teachers for training and, eventually, employment. In each of our districts, the institutional links already exist. LAUSD, for instance, hires well over 70% of its new teachers from just four regional state institutions. The teacher preparation institutions depend in turn on LAUSD as a first employer of their teacher graduates. For example, the School of Education at California State University Dominguez Hills sends 80% of the teachers it prepares into first jobs in LAUSD.

The primary objective for Goal 3 now is to help create a coherent career-spanning professional learning system for educators. The learning system continuum stretches from pre-service content and pedagogy courses to in-service master teacher and faculty professional development. Such a learning system will depend primarily on tight links between the major teacher preparation institutions in a region and the districts into which they send most of their teachers for training and, eventually, employment. Therefore the primary strategy for Goal 3 lines of work is to establish long-term infrastructure support and cultural practices that foster productive relationships among teams of content faculty, education faculty, teacher leaders and experts, and their administrative hierarchies so that they can work together to improve, maintain, and deliver all aspects of the career-spanning teacher professional learning continuum.

Goal 3 will focus on building regional partnerships between SCALE K-12 districts and their affiliated IHE. These regional partnerships have already begun in MMSD and LAUSD. CSUDH is taking the lead in building a strong regional partnership, linking LAUSD and several other California State University campuses in the Los Angeles basin. Fundamental to the regional partnerships is the coordination of K-12 and higher education institutions, alignment with state and federally funded initiatives in mathematics and science, and collaboration with STEM and education faculty and district experts in the co-construction and delivery of improved curriculum, pre-service, and in-service professional development. A similar collaboration began with MMSD and UW-Madison under the National Institute for Science Education (NISE) and the UW-Madison

NSF GK-12 award, K-Through-Infinity (KTI). In 2004, MMSD was awarded an MSP Title Iib grant from the Wisconsin Department of Public Instruction. The program was developed jointly by MMSD and SCALE. MMSD and the UW Mathematics Department created and delivered four 1-credit core mathematics concept courses during the summer and fall of 2004 and spring of 2005, and will repeat these courses in a summer institute this year. The mathematics concept courses were delivered to more than 100 MMSD middle school teachers. MMSD and SCALE have been awarded a second grant to continue and expand the course models in 2005-2006.

We have learned that these promising new practices must be resourced with respect to financial, human, and social resources. Although writing grants for grants' sake can add to incoherence, there is an advantage to doing so under a comprehensive theory of action: it can create new social resources during the proposal conceptualization and writing; it provides a restricted interface across culturally different groups; and if awarded, it provides resources for the proposed lines of work. Figure 3, below, summarizes a variety of the ways in which SCALE has integrated resources and relationships across goals and partners to create new cultural practices and system coherence.

### Seed Projects for Populating Intersections

**Goal 1 – Goal 3 Integration: New cultural practices of systems coherence**

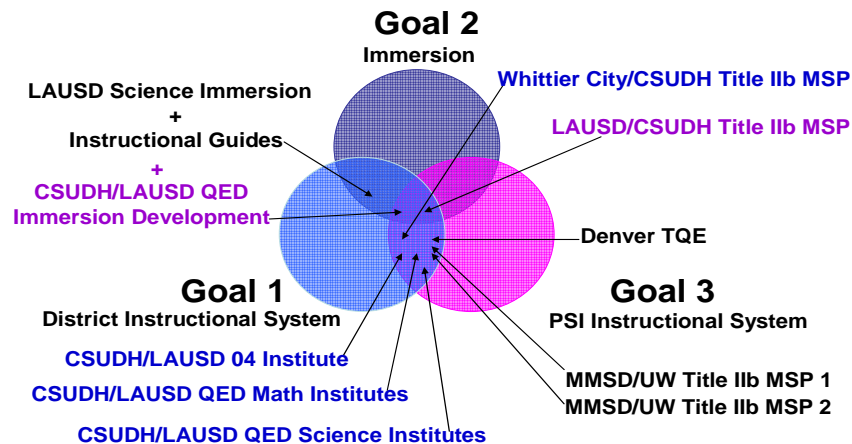


Figure 3. Seed Projects for Populating Goal 1-3 Intersections

#### Los Angeles Unified School District (LAUSD)

Perhaps the most remarkable success of the new Goal 3 for Year 3 has been the coordinated effort in Los Angeles to develop new social networks spanning LAUSD and three of the California State Universities. The California State Universities in the Los Angeles area are not only the primary providers of new teachers to LAUSD but also have played a significant role in the post-credentialed development of those teachers and the district administrators.

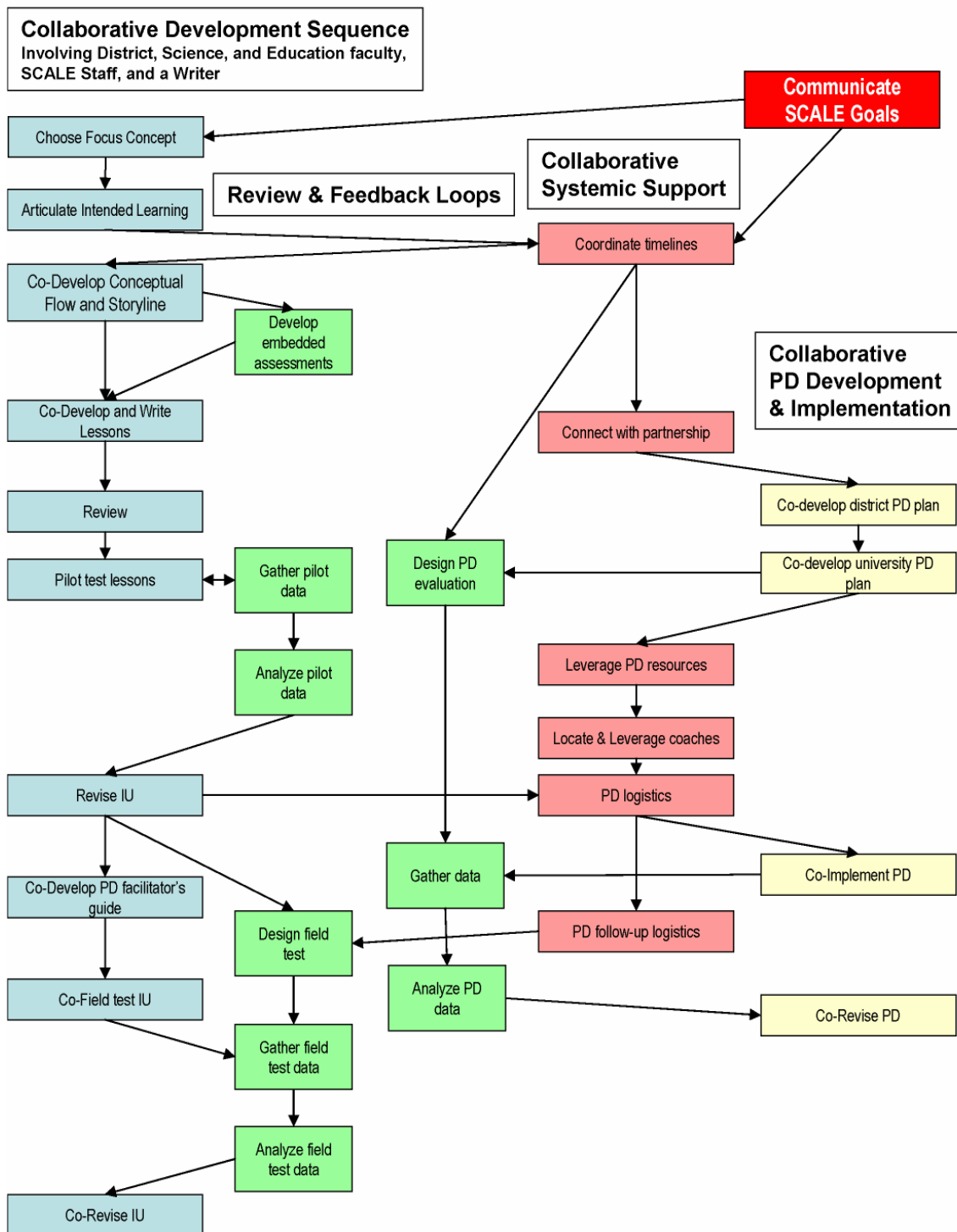
Prior to SCALE, STEM faculty involvement with LAUSD was neither substantial nor coordinated. In order to meet the new primary objective for Goal 3 (the development of a coherent career-spanning professional learning system for educators) it was critical to recruit the STEM and education faculty at the three key CSU campuses in the Los Angeles area into the SCALE work. The lines of work related to this undertaking have

five of the entries in Figure 3 above. CSUDH STEM and education faculty and the LAUSD science leadership have led this effort. These social networks include the LAUSD science leadership teams, district science leaders, local district science experts, and STEM and education faculty from CSUDH, CSU Los Angeles (CSULA), and CSU Northridge (CSUN). This team with other SCALE assistance wrote a successful \$4.9M Department of Education Title II TQE proposal called QED. This proposal was written under the umbrella of the SCALE theory of action and not only was written to directly support science immersion unit development and the associated PD, but also to incorporate those units into the relevant content and methods courses at the universities thereby beginning the transformation to a new paradigm of preparation of mathematics and science teachers. QED has as its focus the professional preparation continuum—from freshmen to post-credential.

A major undertaking of QED is the professional development of the STEM faculty. One of the vehicles for this professional development has been on science immersion co-development for the district Science Instructional Guides, as described in Goal 2. Mathematics and mathematics education faculty have more recently become involved in the development of the concepts underlying “mathematics immersion.” On the next page is Figure 5, a diagram that depicts the science immersion unit, professional development and institute planning, and evaluation development workflow.

The Goal 2 section of this report describes in more detail some of the working groups who have been responsible over the past four months for the significant progress that has been made not only in development work per se, but also in creating and solidifying the new social networks that are they key to the success of these efforts to date. The relationships depicted in Figure 4 are vital to understanding the progress that SCALE has made in starting a regional science partnership in the Los Angeles basin. The various boxes represent actions taken by teams of individuals across multiple organizations, and the relationships among the boxes show the logic of the organizational effort in place to support the overall goals.

## SCALE Science Immersion Unit Development Workflow



**Figure 4. SCALE Science Immersion Unit Development Workflow**

### **Madison Metropolitan School District (MMSD)**

The primary advances in Goal 3 during Year 3 in MMSD center on the growing partnership between MMSD and UW-Madison faculty, primarily in the Mathematics Department. Two Department of Education MSP Title IIB grants, as represented in Figure 4, have provided the primary funding for this new line of work. This year there have been four 20-hour mathematics content courses for middle school teachers, and an additional parallel pedagogy (supported in part by SCALEnet) course for each content course. Each course will be offered again in the summer of 2005.

The faculty contributed content expertise. They learned about K-12 standards, curricula and methods. The Instructional Resource Teachers from MMSD contributed pedagogical expertise and strengthened their mathematical content knowledge through interactions with the faculty. The content and pedagogy courses were directly connected to the curriculum that teachers use in their classroom (Connected Mathematics Project). Here is a quote from one of the participating faculty members:

This interaction lets the University faculty get a real application for what happens in schools. It is all too easy to sit back and pontificate based on questionable memories of what school was like for a faculty member, or on the idea that K-12 schoolrooms are like college classrooms, and a grounding in reality can make it a lot easier for faculty to interact with teachers usefully.

SCALE helped with the organization of this line of work and also provided the evaluation. Thirty-seven teachers participated in pre- and post-testing probability/statistics. Twenty-five participated in the algebraic relations course. Sixteen teachers participated in geometry pre- and post-testing. In the first two courses, 90% of the teachers improved. In the geometry course, 75% of the teachers improved. In all cases, the overall gain was statistically significant. The data for the fourth course, measurement, is not yet available.

### **Denver Public Schools (DPS)**

Denver also has an entry in Figure 4 above because of a successful, collaborative \$9.5M Department of Education Title II TQE written and won by Denver Metro State College and Denver Public Schools. The initial lines of work have involved teams of Denver Metro faculty and DPS content experts working together to review, select and recommend curricula material. The Denver Metro Teacher Education Department and School of Letters, Arts & Sciences, along with DPS teachers, will be jointly involved in teaching and mentoring secondary teacher education students and new teachers from Denver Metro's secondary education pool. In addition, Denver Metro faculty will work with DPS to ensure that college curricula align with what secondary education teachers will ultimately be teaching.

### **Math Immersion**

Science Immersion intended for classroom use is the focus of Goal 2 work. Science immersion also has a professional development component for teachers. During the last year, we started developing a parallel idea in mathematics, but so far we have restricted our math immersion development to the professional learning of teachers rather than for classroom use. For that reason, the work we subsequently have done in "Math

Immersion” is included in Goal 3 rather than Goal 2. During Year 3, SCALE created a Mathematics Immersion Concept Team. This team was formed in September 2004 and has been working to:

- Map out what should constitute math immersion.
- Create a draft *Math Immersion for Middle School Teacher Professional Development* concept paper.
- Develop experimental math immersion resources that are the central mathematical piece to a math immersion unit.

The Mathematics Immersion Concept Team has members from UW-Madison and CSU, Dominguez Hills. In addition, the team has been soliciting input from such faculty as Tom Carpenter, Tom Romberg, Rich Lehrer, and Sharon Derry. The Team shared its first draft of the paper in April 2005, and is now busy digesting the feedback they have received from the SCALE partnership and beyond. The primary focus of the math immersion, in contrast to science immersion, is the mathematics professional development of middle school teachers.

### **Education Partnership Conference**

The Goal 3 team, with assistance from the Goal 0 and CSUDH staffs, was responsible for a successful two-day IHE conference held in the Los Angeles area in March of this year (2005). The conference was sponsored by SCALE, FOCUS (University of California MSP), and QED. There was an excellent balance among the approximately 140 participants from districts, schools of education, and STEM departments from more than 10 IHEs. The conference was organized around the NSF Math and Science Partnership Five Key Features. The purpose of the conference was to extend and strengthen existing partnerships among educational organizations to better serve the mathematics and science education of all students. The conference was intended to be of interest to mathematics and science educators at all educational levels, and for administrators and trainers responsible for the learning and professional development of those educators.

Feedback from attendees indicated that the sessions they attended were informative and interesting. Participants were able to interact with colleagues from other segments of the K-16 educational enterprise. Presenters represented all of the stakeholders in educational system and the ensuing discussions brought into the open the varied perspectives from the various “cultures.” These types of exchanges assist SCALE in determining directions to take to meet its new Goal 3 objective.

## Goal 4: Equity

During the past year, in response to feedback from districts and our cross-district Equity Council, the Year 2 NSF site visit, and our National Advisory Board meeting, we have substantially revamped the SCALE Goal 4 strategy and associated benchmarks. The shift in focus will embed equity strategies in the other SCALE goals and expand the equity emphasis to include English learners and the economically disadvantaged. Specifically, we are now working to identify and document existing disparity-mitigating strategies in SCALE districts, develop and implement equity benchmarks within other SCALE goals, and target one or two specific equity initiatives in each district.

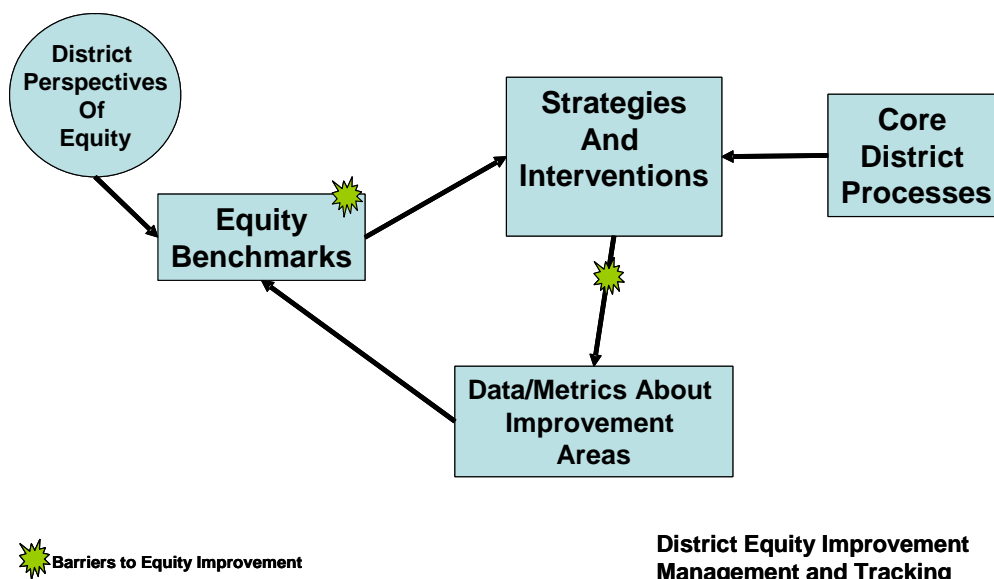
We are using an engineering systems design approach to organize this work. In fall 2004, a literature review on issues of equity in K-12 mathematics and science was conducted. This review was used as the basis to structure conversations with districts around the systemic development of equity goals, strategies, and measures. By the end of Year 3 we expect that:

- All SCALE districts will have a system of equity benchmarks in place.
- The Goal 4 team and districts will have identified barriers within each district that hinder the development of equity-based reforms, particularly as they relate to other SCALE goals.
- Each district will have selected one or two district equity initiatives and developed a plan for monitoring progress on these initiatives.

To review our work on a regular basis, we will create an Equity Advisory Board comprised of experts in the field of equity in K-12 education.

### **Using a Systems-based Model to Identify and Address Equity Issues in the Districts**

Establishing an equitable education system can be approached as a problem in business process design. In our application, the Goal 1 Core Instructional System Dimensions (teaching, professional learning, monitoring, accountability) along with social climate and services constitute the core *functional areas* to which we have applied a systems-engineering analysis. As shown in Figure 5, the resulting framework (here, a simplified version) provides a common structure by which to address equity in the districts.



**Figure 5. Framework for Thinking About and Addressing Equity in SCALE Districts**

The framework structures the process of analyzing a district’s status and planned efforts with respect to equity. It leads to identification of a set of benchmarks, planned strategies and interventions and data/metrics for monitoring equity. *Benchmarks* are both academic (primarily student achievement) and non-academic (e.g. school climate, parent involvement) measures of equity within each district and within individual schools in the districts. Examples of equity benchmarks are provided in the draft paper produced by R. Halverson and M. Besterfield-Sacre. *Barriers* are the primary impediments to the cyclical functioning of the benchmarks-strategies/interventions-data system. Barriers can occur between two parts of the model (e.g. creating metrics to measure specific interventions) or within one part (e.g. the development of benchmarks). In this way, the development of equity metrics can be seen as a barrier to the effective functioning of the equity system and can be addressed as such. (Note: In Figure 5, the placement of barriers is meant for representation purposes, not as accurate depictions of where districts perceive their barriers to be.)

To date, this analysis has been conducted in three of the four districts—Providence, Denver and Madison. We will conduct the analysis in LAUSD in fall 2005.

### **Providence Public School District (PPSD)**

In PPSD, Goal 4 and 5 researchers conducted interviews with the district’s Interim Superintendent, the Chief Academic Officer, and the Directors of all district departments including Student Services, English Language Learning, and Special Education. Interviews were also held with the Youth Development Facilitator and instructional coaches in mathematics and science.

Interviewees identified key barriers to the effective functioning of their equity improvement system, which is embedded their extensive data tracking system (called *data dashboard*) and their detailed school-level action plans. In multiple interviews, three issues repeatedly surfaced as ways in which the district’s attempts to create a systematic approach to equity and access were being thwarted. The three major barriers are: 1) master scheduling, 2) the discipline system, and 3) teacher attitudes and beliefs. PPSD

has selected master scheduling at the school level as the specific equity initiative that it will focus on during the next school year.

The master schedule is a key to linking high expectations and equal access for all students to the daily practices of individual schools. Currently, the master scheduling process appears to be divorced from practices of teaching and learning, despite the fact that the schedule both constrains and affords access to rigorous curriculum and high expectations. In business production terms, the master schedule is the “production schedule” of a school. It is the school’s attempt to balance all of its key resources (classrooms, teachers, syllabi, laboratories, etc.) to produce learning. Despite verbal commitments to equity, access to courses for minority and poor students are often not considered in this balancing act. For example, there might be an English Language Learner student who is very good in mathematics but is prevented from taking an advanced mathematics class because ELL support classes are scheduled at the same time. The Goal 4 team will work with PPSD next year to develop new processes that incorporate equity and access as primary variables in the development of a school’s master schedule.

### **Denver Public Schools (DPS)**

Goal 4 researchers worked with DPS staff in May 2005 to populate its equity improvement management and tracking system with DPS-specific benchmarks, strategies and interventions, core processes, metrics for improvement, and, most significantly, barriers to the effective functioning of this system. This has been accomplished through a series of interviews with district staff as well as a daylong retreat with 25 key district members whose work affects issues of equity and access in the district. Co-facilitated by Goal 4 researchers and DPS Executive Director of Teaching and Learning Rosanne Fulton, attendees included teaching and learning coordinators from all disciplines, the Director of the Mayor’s Office for Education and Children, members of Denver Metro State faculty, and directors of other DPS departments. This meeting resulted in the identification of five key barriers:

- Professional development does not infuse issues of equity into curricular content.
- DPS has not made decisions about what students need in order to succeed, nor are they currently measuring whether they are able to do so.
- Lack of parental involvement. Parents from disenfranchised communities do not feel like they belong, nor do they feel empowered to become involved or to make changes in their school communities.
- Many DPS teachers do not have high expectations for all of their students, particularly for students of color.
- Lack of accountability structures for DPS teachers to build strong, positive relationships with their students.

Goal 4 researchers and DPS staff have worked to develop strategies that could address all of these barriers. This team has proposed four complementary lines of work, outlined in the table below:

Strategy	Barriers Addressed	Proposed timeline
School climate survey re-design	The current DPS school climate survey, recently rolled-out district wide, is given to teachers, students and parents but does not specifically address issues of parental empowerment, high expectations, or student-teacher relationships. (Addresses barriers 2, 3, 4, 5.)	Re-design: Summer & Fall 2005 Pilot: Winter 2006 Analysis: Spring 2006 Re-design: Summer & Fall 2006 Roll-out: Winter 2007
Design of “data dashboard” with equity lens	Bringing an equity lens to the design of a data dashboard can bring barriers 2-5 to the forefront as a means to create relevant data points across the district that document systemic changes in equity.	Initial brainstorm & planning: Summer 2005 Construction of prototypes: Fall 2005 User testing of prototypes: Winter 2005 Construction of system: Spring 2005-Spring 2006
Professional development that integrates issues of equity into content	Primarily addresses barrier #1 but will also address #4 and #5.	TBD, dependent on DPS teaching and learning staff
Development of narrative tool for evaluating students’ experiences with the DPS system	Connected to barriers #4 and #5. More generally connected to the importance of bringing kids’ voices into our ways of analyzing schools.	Brainstorm project development with Goal 4 researchers and DPS staff: Summer and Fall 2005

### **Madison Metropolitan School District (MMSD)**

MMSD has developed a number of initiatives related to building an understanding of race and equity among staff in the district and changing practices to reflect this understanding. Board of Education priorities were developed specifically to address the significant achievement gaps that have historically been evident in the district. In addition, departments at the district level are developing action plans for addressing the elements of the framework as they relate to race and equity.

MMSD has established a set of equity goals to build capacity within the general education environment to be able to serve all students. They are committed to developing a systematic way to deal with students who are struggling, to have high expectations for all students, and to provide equal access. MMSD has identified several key benchmarks to measure equity across the district: 1) 94% attendance, 2) all Grade 3 students reading at a proficient or advanced level, and 3) all Grade 9 students completing algebra and all Grade 10 students completing geometry. In addition to improvements in teaching and learning, district strategies for attaining these benchmarks include: building strong, positive relationships between students and classroom teachers; improving master scheduling at the school level; rethinking the way the district deals with behavior problems and providing differentiated instruction. The district also is improving the School Improvement Planning (SIP) process and sponsoring explicit discussions about race.

The primary barrier to effective system functioning that has been identified in MMSD is the lack of effective communication between departments within the district. All projects undertaken around Goal 4 will be designed to create a system that closes the loops between the teaching and learning department (where the majority of SCALE work is undertaken), Assistant Superintendents (to whom school principals report), principals, and classroom teachers.

Goal 4 staff will propose the following projects for MMSD's equity work:

1. The structure and design of an assessment system that holds teachers and schools accountable for all of their students' success.
2. An examination of the grading and reporting system.
3. A well-documented study of all equity issues and barriers around mathematics and science teaching and learning in one of MMSD's four comprehensive high schools.

We will decide in the summer of 2005 which project(s) to pursue during the next school year.

### **Los Angeles Unified School District (LAUSD)**

Because of its size and added complexity of sub-districts, a decision was made to address LAUSD after first working with the other three SCALE districts. A separate Goal 4 district liaison will be hired to work with LAUSD on equity concerns. Meanwhile, LAUSD has already been developing a plan for intensive efforts in mathematics for low achieving students in its middle schools. The plan entails:

- Augmentation of LAUSD's adopted mathematics textbooks with common, rigorous lessons. One such lesson has been introduced each quarter of the past year. Additional lessons will be introduced in each of the next two years.
- Intensive professional development (10 days, in addition to the district's regular program) for teachers in low achieving schools.
- Coaches on a ratio of one coach to 30 students, each coach specializing in a particular grade level and portion of the mathematics content.
- Enhanced period assessments.
- Alignment of after-school, weekend and intersession intervention programs in mathematics to the school's core curriculum.

### **Research Studies on Equity**

During SCALE Years 1 and 2, we conducted two research studies on equity in STEM studies. Their results will be formally reported by the end of Year 3.

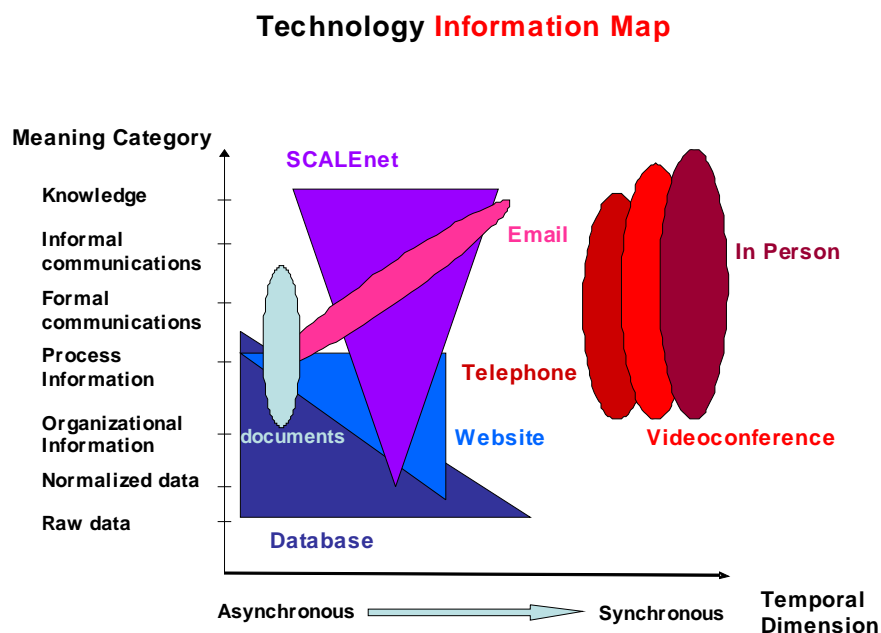
*How to Empirically Identify and Document Disparity Mitigating Strategies.* In an effort to provide a framework for analyzing the impact of various equity reforms over a longitudinal time frame, we used national data sets to develop a methodology that can be used to identify interventions applied at to Grades 8 and 10 that potentially "close the equity gap," as shown by Grade 12 mathematics scores. We developed a mathematical model using cluster analysis and dynamic programming to determine those "paths" that maximize math scores, while minimizing resources. The National Education Longitudinal Study of 1988 (NELS:88) database, although somewhat dated, has provided the necessary longitudinal data to develop and test this methodology. The model and

methodological approach may be utilized to make suggestions for specific racial and economic groups that may lead to the reduction of the mathematics achievement gap. Three ethnicity groups (Caucasian, African American, and Hispanic) were analyzed separately to identify specific strategies to close that achievement gap. To provide a finer level of granularity each race was further subdivided into economic groups. These methods can be applicable to the SCALE Indicator System. A paper is being prepared this summer to be submitted for publication.

*Investigating Equity Difference Between STEM and Non-STEM College Freshmen.* To complement the efforts of Goal 3, we conducted a study aimed at identifying factors that predict who undertakes STEM college studies among minority and female students. The data base for this study was The Cooperative Institutional Research Program (CIRP), a national longitudinal study of the American higher education system. Administered by the Higher Education Research Institute (HERI), the CIRP is a comprehensive source of information on pre-college students, involving data on some 1,800 institutions and over 11 million students. The survey asks for students' attitudes and backgrounds over a comprehensive set of items (e.g. personal life, college and higher education, and future objectives). Four years of data were used (2000 through 2004) to develop and test a logistic regression model to predict successful STEM study. This model has been applied to African-American and Hispanic students in two universities, in the northeast and southwest. A full report will be ready by the end of Year 3.

## Goal 0: Management

Although Goal 0 (administration and technology) did not have explicit benchmarks in the Year 3 Implementation Plan, it did have a scope of activities that were anticipated for Year 3 work. All of these activities have been accomplished and in fact are ongoing (see Year 4 Implementation Plan). The primary focus of Goal 0 is to facilitate the work done in Goals 1-5. One of the primary functions of both administration and technology is information and communication management. Figure 6, below, provides taxonomy of the relevant information and communication technologies used by SCALE on a graph whose horizontal axis gives a temporal dimension and whose vertical axis gives a meaning, or information complexity, measure.



**Figure 6. Technology Information Map**

One of SCALE's major accomplishments is the substantive use of the commercial-grade knowledge management system (SCALEnet) to facilitate communication and information flow in a way that helps minimize information entropy and maximize knowledge production. Since purchasing the Vignette Business Collaboration Server software (formerly Intraspect) for SCALEnet, the system has grown dramatically in use and content. To date, the collaborative workspace has 483 users total. This user population includes SCALE personnel from each institutional partner (Denver Public Schools (DPS), Los Angeles Unified School District (LAUSD), Madison Metropolitan School District (MMSD), Providence Public School District (PPSD), University of Pittsburgh, University of Wisconsin–Madison, California State University Dominguez Hills (CSUDH), and Vanderbilt University) as well as representatives of the National Science Foundation and members of the SCALE National Advisory Board. Also included in this user group are non-partner specialists associated with lines of work (Carnegie-Mellon University and Rand Corporation, for example), Math Masters participant teachers from MMSD and other districts using the space for a professional development (PD) platform, and teachers involved in immersion training from LAUSD, Pittsburgh Public Schools,

and MMSD. Work and content contained within SCALEnet covers all the SCALE partnership goals and administrative functions. Currently the SCALEnet database contains 45,000 objects.

Often when working to build new social networks across organizations—such as collaborations among IHE science and science education faculty and science experts at the district level—it is important to give new community members a workspace that supports exchange of documents and the management of shared tasks. By definition, this work extends beyond the borders of each institution's information systems and may require collaborative features. The ability to create and customize secure, web-based workspaces across and within partnering organizations has provided a competitive advantage to SCALE compared to other initiatives at play in a district at any given time. Being able to permeate organizational boundaries and create such shared space is an important attractor of SCALEnet for SCALE and its many teams.

In Year 3, the SCALE Administrative Office refined the system to maximize effectiveness and remove barriers for adoption. Through piloting and feedback from users, the SCALE Administrative Office analyzed the strength, flexibility, and opportunities for wider deployment SCALEnet.

#### *Quantitative Estimates of SCALE Influence on Teachers and Students*

Another accomplishment of Goal 0 in Year 3 was to successfully submit SCALE participation and event data to NSF and the MSP MIS reporting system. From these data, we have developed quantitative estimates of the number of teachers and students influenced by SCALE efforts (primarily through professional development provided by Goals 1 and 2) during the 2003-2004 school year. Appendix I describes these data and two proxy variables that measure the impact of SCALE on teaching and learning. The number of teachers who have been exposed to SCALE professional development provides a measure of the impact that SCALE is exerting on partnering districts' faculty and provides a basis for estimating the number of students exposed to SCALE.

Event data and district information systems were queried to produce counts of teachers, coaches, and lead teachers who attended SCALE-related professional development. Also included in those counts were school-level teachers who were subsequently influenced by those trained. During the 2003-2004 school year, we estimate that 1517 LAUSD teachers, 207 PPSD teachers, 612 DPS teachers, and 166 MMSD teachers were influenced by SCALE. We extrapolated to estimate the number of students who were exposed to learning SCALE-influenced mathematics and science curriculum. For example, for the 1517 teachers in LAUSD at SCALE schools, one might estimate 32 students per teacher, or about 50,400 students as being exposed to instruction that has been informed by SCALE-related professional development in LAUSD. For details and a graph of these estimates, please refer to Appendix I. More recently, SCALE data collection for the MSP MIS reporting and the SCALE quality indicators system has been improved to more accurately capture an increasing series of SCALE activities for Years 3, 4 and 5.

## **Lessons Learned**

SCALE's intentions, expressed in our proposal and elaborated in our Strategic Plan, are ambitious. Our primary aims are to impact the: 1) entire mathematics and science programs of four large school districts, to change the way "normal business" is done in each of them, and through these changes to raise achievement and motivation for mathematics and science learning, especially among underserved minority and poor students; 2) teacher preparation and professional development programs of the regional institutions of higher education of the four districts; and 3) fundamental regional relationships of SCALE districts and participating institutions of higher education. To achieve these aims we knew we had to develop and apply leveraging strategies—positioning relatively small amounts of direct intervention in ways that would spread through whole complex social systems. The primary four SCALE Goals (1-4) were organized with these aims and strategies in mind.

Thus, understanding, managing, and using instruments of change (SCALE as a change agent) are the most challenging aspects of SCALE work. All of the SCALE Goals are pursued through co-construction of district policy, university policy, and organizational process. Our methods of co-construction are multiple, indirect, context-specific, and subject to rapid change, development, and evolution. The most important lessons learned in SCALE to date are about navigating these complex organizational waters, while maintaining an overall clear heading toward the ultimate SCALE Goals.

The four Goals entail their own distinctive change instruments, such as strategic planning meetings with district leadership, funding of experimental professional development, development of rubrics for district monitoring functions, development and piloting of immersion units, revision and testing of new approaches to pre-service education, partnership-wide professional development sessions, and others. SCALE also has become involved in technical assistance supportive of its main goals, such as providing tools for analyzing alignment of standards, assessments, and curriculum. In addition to these SCALE instruments of change, district leadership and coaches receive training from IFL. While the IFL work began prior to SCALE, the content of the IFL meetings already has incorporated various SCALE innovations, most notably the incorporation of the immersion units into the training of coaches and IFL-wide refinement of SCALE-developed rubrics.

### **District Math and Science Instructional System**

SCALE learned early on that defined core structures and a framework for district decision making are needed to make the leveraging strategy work. The Goal 1 team created a design for policy making that could guide the districts through a systematic set of decisions concerning curriculum, professional learning structures and accountability. This design has been useful as a device for planning retreats, and for in-district self-evaluation as well as providing a framework for SCALE evaluation. We have learned that the SCALE districts have found this design structure useful, and the Goal 1 team has helped them apply it not only to mathematics and science but to the full array of core curriculum and thus to district policy as whole.

SCALE also has learned that establishing teaching, monitoring and professional learning systems effective in producing learning is a multi-year undertaking. One of the most

difficult tasks of leaders of school districts is monitoring the success of policies they have implemented and deciding when changes are needed, and then carrying out those changes without destroying the morale of participants. SCALE has had the opportunity to work with LAUSD to learn how to more effectively do this for middle school mathematics.

Due to poor middle school performances on the interim tests, SCALE was asked to guide a process of analyzing the problem and developing solutions. Together, SCALE consultants and district personnel reached the conclusion that the guides were confusing in structure and not well connected to the core conceptual content in the California State standards, nor did they align with what the district wanted to promote. They also concluded that the district's interim assessments were focused too much on predicting the end of year high stakes test scores and not enough on modeling the kind of "big idea" teaching that the district wanted. Together, they worked extensively to plan to build a more conceptually grounded set of instructional guides for mathematics and to change the interim assessments to include more conceptual tasks.

SCALE has learned that good policies do not automatically change classroom practice and hence learning. Sometimes they can even produce "lethal mutations"—changes that move practice in a direction opposite to the one intended. For example, major new policies, especially ones that depend on new knowledge on the part of educators and on changed relationships among those working in the system, cannot be simply announced and enforced. They have to be woven into the culture, built up from the bottom at the same time as they are announced at the top. It is proving easier to do this in districts the size of PPSD and DPS (which are still quite large) than in LAUSD. We expect in a year to have more to say about how to systemically solve this problem.

Finally, SCALE has learned the art of sustainability across transitions. Two of the four SCALE districts, PPSD and DPS, are in the process of senior leadership transitions. In both districts, in anticipation of the transition, SCALE was called on to work with senior staff and board members. Both districts' school boards have formally adopted resolutions that the policies developed in collaboration with the IFL are official policies intended to continue across the superintendent transition. Both boards expect the incoming superintendent to maintain the general direction in which the district and SCALE have been moving. The reason for the likely smooth transition appears to be board buy-in to the district/SCALE theories of action. The important lesson here is that sustainability calls for working with many constituencies in a district—including professional staff specific to our SCALE initiative, senior professional leadership who set the broad context within which our SCALE programs function, policy makers (including both superintendent and board) and, as appropriate, other stakeholders such as unions, parent groups, and local organizations including civic groups and, non-profit agencies and IHEs.

### **IHE Teacher Preparation and Professional Development**

IHE Teacher Preparation and Professional Development are much less developed areas since they have required infusing new inter-institutional perspectives into intra-institutional cultures. As described under Goal 3, SCALE is experimenting with a variety of strategies for better aligning IHE teacher preparation and professional development with district policies and practices. SCALE is working to base these strategies on sound principles, the experiences of the partners that are relevant, and the actual relevant circumstances within each district. In Denver, SCALE is learning from the work done by

the NSF Center for the Excellence in Teacher Preparation Rocky Mountain Collaborative (RMTEC). In Los Angeles, SCALE is learning from the work done by the NSF Center for the Excellence in Teacher Preparation Los Angeles Collaborative (LACTE)—taking advantage of the existing network among IHEs established by that collaborative. In Madison, SCALE has been learning from previous, parallel work between MMSD and UW-Madison, such as with the Center for Biology Education, the School of Education, the NSF Materials Research Science and Engineering Center at UW-Madison, and the NSF GK-12 K-Through-Infinity Partnership. Each of these previous networks of relationships is providing relevant, site-specific pathways and valuable lessons for eventually having a district-mediated impact on the IHE pre-service teacher preparation, the IHE professional development that is offered, and coordination not only between these two features, but also with district policies and practices.

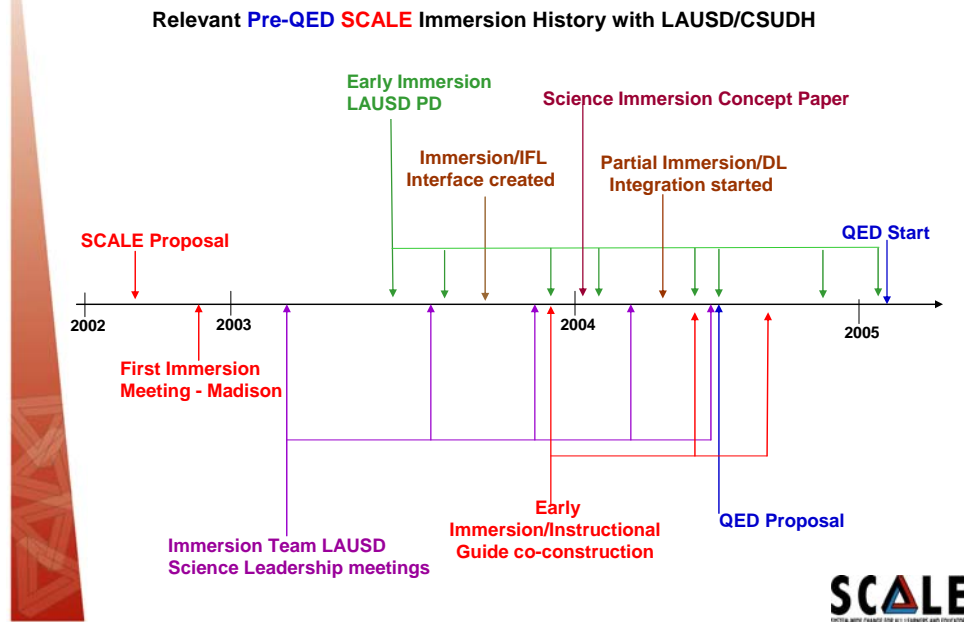
We have learned from the success of the science immersion in Goal 2 and attempted to translate that learning into what we are calling mathematics immersion. We have done that by looking closely at and learning from relevant previous experiences at UW-Madison, CSUDH, and elsewhere. We believe we have learned how to add to the language and concepts used to discuss what mathematics instruction and mathematics professional development should “look like.” In particular, we feel that Perkins’ concept of an explanation structure is an excellent way to say what teachers must have in order to provide learning environments where students learn mathematics with understanding—they must have robust, extensible, and revisable mathematics explanation structures (From *Software Goes To School: Teaching for Understanding with New Technologies* (Chapter 5: *Inside Understanding*) Eds. D. N. Perkins, J. L. Schwartz, M. Maxwell West, and M. Stone Wiske. Oxford University Press, Inc. 1995.). This language may help in the common debate about what teachers need in order to improve their mathematics content and pedagogical content knowledge. We also hope that the math immersion units that we are designing eventually can be used for teacher professional development in ways that all sides see as valuable.

### **Regional Partnerships**

A fundamental lesson that SCALE has learned in the domain of Regional Partnerships is the importance of working to change cultural practices and assumptions across institution types. A related lesson that SCALE has learned is that in order to start such transformations, it is important to jointly work on problems that 1) are concrete and meet immediate needs, and 2) have the proper financial, human, and social resources, and do so with teams that have representation from a cross-section of the relevant regional institutions. SCALE has learned valuable and different lessons from each of the lines of work depicted in the various intersections of the diagram in Figure 4 in the Goal 3 section above.

Another lesson that SCALE has learned is that in order to bring such activities to scale, it takes coordinated, long-term, resourced efforts that are aligned with institutional practices, resources, and needs. The sustained success of what is now the LAUSD Science Instructional Guides/Immersion lines of work is an excellent example. This work involves SCALE, LAUSD, CSUDH, CSUN, and CSULA. The following diagram captures some of the components of the history and initial organization of this effort:

## SCALE/QED/LAUDS/CSUDH Immersion/Instructional Guides Review



**Figure 7. Pre-QED SCALE Immersion History with LAUSD/CSUDH**

All of the activities represented in Figure 7 pre-date the launch (in February 2005) of the actual teams and lines of coordinated work that are represented in Figure 3 in the Goal 3 section of this report. Each network of activities was important for setting aspects of the stage upon which the systems approach represented in Figure 3 has been built. SCALE learned many “atomic” and “molecular” lessons in the “pre-history.” These lessons in turn helped elevate the learning plane of the current work to a “compound” organizational and systems level.

Looked at more abstractly, the SCALE work in Goal 3 has underlined the importance of:

- Coherent co-development and co-production by districts and local IHEs of curricula material and professional development by a network of a district with its regional IHEs linked with and followed by:
- Coherent implementation of district policy and practice across the five dimensions of Goal 1 (curriculum, professional learning, monitoring, accountability, system leadership and management).

There are at least two intentional features in addition to coherence and co-construction:

- Capacity for going to scale (finding ways to ensure that the network/district partnership operates on a large scale, across multiple grades in both mathematics and science);
- Sustainable institutionalization (finding ways that ensure that the new pattern of institutional collaboration and implementation will likely persist after SCALE ends, meaning understanding why both external agents and district implementers will want to persist with the vision and maintain and adapt the new operating partnership and routines even under changed circumstances).

What must be worked out carefully, based on our experience to date and future experience (many aspects of the relevant work are just underway), is how these lessons can help conceptualize such aspects of our work as:

- Success in organizing multiple IHEs around the common tasks of producing both curriculum and PD that is highly and successively more responsive to district needs as implementation proceeds;
- Success in district and local IHE co-constructing products and implementation (rollout) in ways that produce successively more alignment with district curriculum vision and standards (dimension 1 of the Instructional System), district standards of best practice in professional development (dimension 2 of the Instructional System), district monitoring systems (dimension 3 of the Instructional System), district accountability (dimension 4 of the Instructional System), and district system management (dimension 5 of the Instructional System).

## **Appendix 1: Quantitative Estimates of SCALE Influence on Teachers and Students**

## **Quantitative Estimates of SCALE Influence on Teachers and Students**

This appendix describes two proxy variables that measure the impact of SCALE on teaching and learning. First, the number of teachers who have been exposed to SCALE professional development provides a measure of the impact that SCALE is exerting on partnering districts' faculty. Secondly, the number of students who are taught by those teachers provides a measure of the degree to which SCALE is influencing the instruction that students within each district are receiving. This section describes the method in which these variables were computed, the assumptions behind those methods, and the values for the 2003-2004 school year data.

Calculating the number of teachers who have been exposed to SCALE related professional development during the 2003-2004 school year depends on several factors. Obviously, the number of teachers who attended SCALE related professional development sessions is a major factor, but there are other factors that can facilitate or inhibit the number of teachers influenced by SCALE work. First, many of the SCALE curricular and professional development sessions are designed to influence key staff within districts and schools, who then share with others in the district and schools. Thus, teachers and specialists who attend SCALE professional development sessions have the opportunity to return to their school and influence other staff and faculty at their schools. Examples of other factors include the number of sessions attended, the length of the session, and local and district support for implementing SCALE related changes. Another factor affecting the estimated number of teachers impacted by SCALE is contributing is the likelihood that not all teachers attending professional development sessions were identifiable. We believe that it is likely that not all attendee data was collected, resulting in an underestimation of the number of SCALE schools influenced by SCALE related professional development. All of these sources of variance are being addressed in the design of the SCALE Quality Indicator System (SQIS).

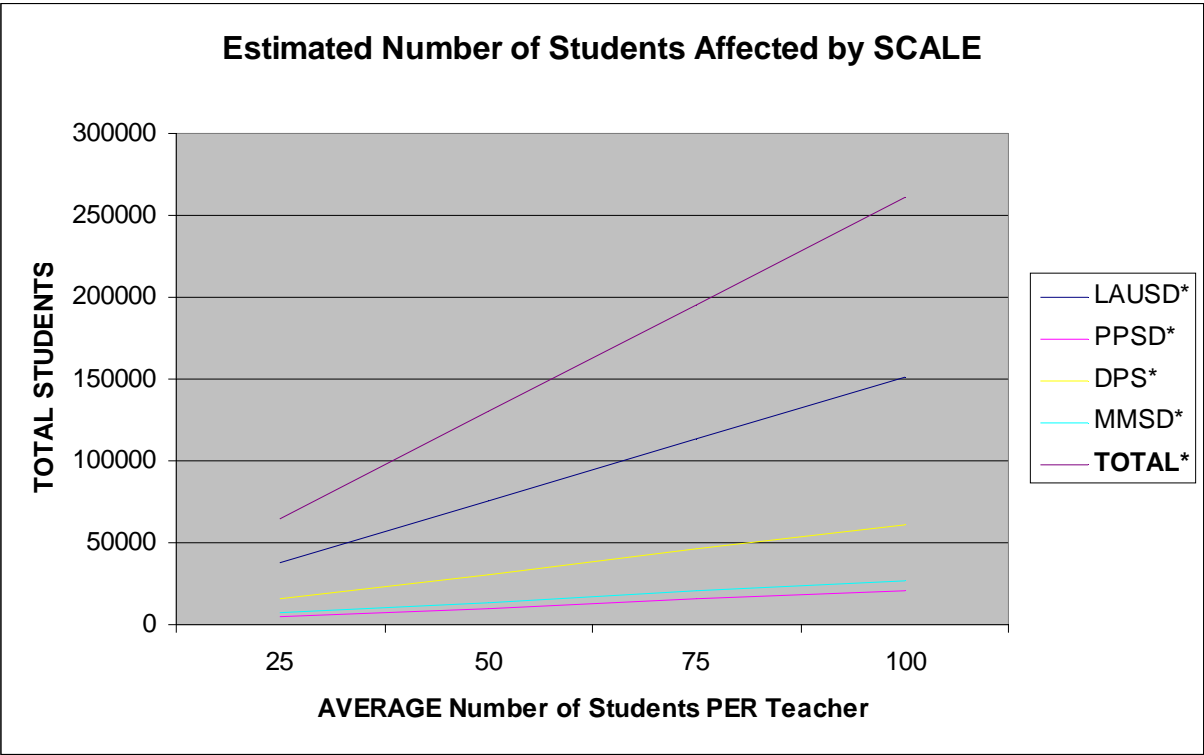
Until the SQIS is implemented, we have adopted the following strategy to track the impact of SCALE on schools, teachers and students. First, schools are identified as SCALE schools when one of two conditions is met. One condition is simply having evidence of teacher attendance of at least one professional development session. The other condition is the recommendation of district staff that stipulates a specific school or group of schools was targeted by SCALE related activities. Once SCALE schools are identified, all math and science teachers at those schools are assumed to be affected by SCALE activities, regardless of the apparent number of teachers who attended SCALE professional development sessions. District information systems were queried to produce counts of these teachers at those schools (Table 1). This estimate is probably near the upper boundary of the number of participating teachers for 2003-2004 depending on the true nature of the degree to which SCALE related ideas were adopted by teachers and the accuracy of attendance records.

**Table 1. Teacher counts and demographic breakouts for SCALE schools.**

	LAUSD	PPSD	DPS	MMSD	MMSD <sup>1</sup>
<b>TOTAL</b>	1517	207	612	270	166
MALE	807	93	289	114	62
FEMALE	680	114	323	156	104
HISPANIC	319	34	97	9	6
AMER IND	17	1	3	1	1
ASIAN	249	4	11	8	5
BLACK	218	26	35	4	2
P ISLAND	2	0	0	0	0
WHITE	708	142	465	248	152
MORE THAN 1 RACE REPORTED	1	0	0	0	0

Calculating the number of students who were impacted by SCALE related professional development can also be estimated through teacher/student ratios. For example, LAUSD has roughly 800,000 students and 25,000 teachers, a ratio of about thirty-two to one. Thus, for the 1517 teachers in LAUSD at SCALE schools, one might estimate 32 students per teacher, or about 50,400 students as being exposed to instruction that has been informed by SCALE related professional development in LAUSD. To accommodate uncertainty in student to teacher ratios (i.e., elementary teachers would teach fewer students than middle or high school teachers, not all teachers work full time, etc...), Figure 1 represents the number of students across a range of student to teacher ratios. It is expected that somewhere between 65,000 and 200,000 students received instruction informed by the SCALE project. It should also be noted that student to teacher ratios vary across districts, and would be represented by a jagged line across the district slopes in Figure 1 rather than by a straight vertical line.

**Figure 1. Estimated number of students receiving instruction influenced by SCALE.**



## **Appendix 2: Implementation Matrix**

The Implementation Matrix is designed to organize activities by project goal. The matrix indicates each of the project's goals and identifies the corresponding activities that were to be concluded in support of each goal in the past year (as delineated in the SCALE Strategic Plan and prior year's Implementation Plan). The status of progress on each activity is indicated, with explanations provided as necessary.

**Exhibit 1: Goal One Activity: Implementation Matrix (June 2004 – June 2005)**

<b>Activity:</b> As delineated in SCALE Strategic & Implementation Plans	<b>MSP Key Feature:</b> (See Appendix)	<b>Progress to Date:</b> (Check one; enter date where appropriate)					<b>Brief explanation for changes where an activity has not been carried out as planned:</b>
		<i>Activity Carried Out as Planned</i>	<i>Activity Delayed</i>	<i>Activity Revised</i>	<i>Activity Eliminated</i>	<i>New Activity Submitted</i>	
District Planning and Implementation	3	X					
Curriculum Advisory Group – and creating course sequences	3			X			The scope of the curriculum advisory group changed to focus on identifying mathematics and science specialty schools serving a diverse student body and to document their progress.
Collecting video	4		X				Much of the videotaping has up to now focused on video for professional learning purposes. Beginning in Year 3 SCALE/IFL will begin collecting video examples of math and science teaching in SCALE districts.
Professional Development	2	X					
Rubric Development	2	X					
IFL Events, DL Institutes and in-district work	2	X					
Incorporate rubrics into districts professional learning systems	3						
Disciplinary Literacy team to introduce two new topics at the middle school level.	2	X					
IHE conferences	5			X			Moved to Goal 3.
Interim Monitoring of math and science instruction	5	X					

**Exhibit 1: Goal One Activity: Implementation Matrix (June 2004 – June 2005)**

<b>Activity:</b> As delineated in SCALE Strategic & Implementation Plans	<b>MSP Key Feature:</b> (See Appendix)	<b>Progress to Date:</b> (Check one; enter date where appropriate)					<b>Brief explanation for changes where an activity has not been carried out as planned:</b>
		<i>Activity Carried Out as Planned</i>	<i>Activity Delayed</i>	<i>Activity Revised</i>	<i>Activity Eliminated</i>	<i>New Activity Submitted</i>	
Accountability measures project student proficiency to increase at 5% increments from the baseline	4	X					
Implementing periodic assessments	5	X					

**Exhibit 1: Goal Two Activity: Implementation Matrix (June 2004 – June 2005)**

<b>Activity:</b> As delineated in SCALE Strategic & Implementation Plans	<b>MSP Key Feature:</b> (See Appendix)	<b>Progress to Date:</b> (Check one; enter date where appropriate)					<b>Brief explanation for changes where an activity has not been carried out as planned:</b>
		<i>Activity Carried Out as Planned</i>	<i>Activity Delayed</i>	<i>Activity Revised</i>	<i>Activity Eliminated</i>	<i>New Activity Submitted</i>	
Immersion Unit Writing Team Institute at BSCS June 26 -28, 2004	1	X					Training for all SCALE immersion unit writers and developers by Biological Sciences Curriculum Study (BSCS) director and staff. This training assisted in forming the foundation for immersion unit inquiry-based curriculum development and provided a key collaboration with other NSF funded programs.
SCALE Goal 1 and Goal 2 Integration Meeting June 29, 2004	1	X					This two day meeting highlighted the development of the immersion units and the alignment with the Disciplinary Literacy work at the IFL. Based on the outcomes of this meeting a more coherent plan of action for Goal 2 in the SCALE districts was developed.
LAUSD Science Instructional Guides and Immersion Unit Training July 15-19, 2004	1,2,3,5	X					These trainings were the first immersion unit trainings identified under the LAUSD science instructional guides. Approximately thirty Grade 7 teachers, eighty Grade 4 teachers, and thirty Grade 5 teachers were trained.
MMSD Science Immersion Unit Planning Meeting August 2004	1,3,5	X					Working with the district science leadership, a 2004 – 2005 school year immersion unit development and PD timeline was established for Grade 4, Grade 7, and Kindergarten. The outcome of this meeting included the identification of immersion unit development teams for each unit with district science leadership, teachers, SCALE writers, and STEM faculty as reviewers of materials under development.
SCALE Goal 1 and Goal 2 Immersion Unit Development Teams Institute September 2004	1	X					To continue to bring together the expertise at the university of Pittsburgh and Wisconsin, a collaborative development institute was facilitated by the Associate Director of BSCS. The outcomes of this meeting allowed for building a more coherent notion of immersion and how it is supported by the research around how students learn.

**Exhibit 1: Goal Two Activity: Implementation Matrix (June 2004 – June 2005)**

Activity: As delineated in SCALE Strategic & Implementation Plans	MSP Key Feature: (See Appendix)	Progress to Date: (Check one; enter date where appropriate)					Brief explanation for changes where an activity has not been carried out as planned:
		Activity Carried Out as Planned	Activity Delayed	Activity Revised	Activity Eliminated	New Activity Submitted	
MMSD Immersion Unit Collaborative Development Meetings for Grade 7 Earth History August-October 2004	1,2	X					During the months of July and August 2004, an immersion unit development team met every other week to co-construct an immersion unit to meet the district needs in Grade 7 Earth History. This team included SCALE writers, district science leadership, STEM faculty from the UW geology museum and graduate students.
Goal 1 and Goal 2 IFL / SCALE National Disciplinary Literacy Institute October 2004	1,2,3	X					The science portion of this institute was designed to provide the four SCALE districts (and other IFL districts) with a foundation for DL science and immersion. Specific strategies and tools for professional development sessions were introduced for implementation back in their districts in order to continue to build capacity.
MMSD Immersion Unit Training Grade 7 Earth History (Plate Tectonics) October 2004	1,2,3	X					This one day immersion unit training to establish a field test group for the Grade 7 unit on Plate Tectonics was co- presented by UW faculty, district leadership, and SCALE developers.
LAUSD Science Leadership Meeting December 2004	1,5	X					Working with the science leadership in LAUSD, SCALE was able to outline the next year of immersion unit development and trainings for Grades 4-8. Outcomes of this meeting included scheduling of immersion unit updates with the elementary and secondary science leadership at their monthly meetings in LAUSD.
LAUSD Grade 4 and Grade 7 Immersion Unit Trainings December 2004	1,2,3	X					Under the California Math Science Partnership grant awarded to LAUSD, immersion unit training was provided to approximately fifty Grade 3 and twelve Grade 7 teachers. This training provided the development teams with additional field testing documentation for revisions and classroom visitation for the units as they were implemented.

**Exhibit 1: Goal Two Activity: Implementation Matrix (June 2004 – June 2005)**

Activity: As delineated in SCALE Strategic & Implementation Plans	MSP Key Feature: (See Appendix)	Progress to Date: (Check one; enter date where appropriate)					Brief explanation for changes where an activity has not been carried out as planned:
		Activity Carried Out as Planned	Activity Delayed	Activity Revised	Activity Eliminated	New Activity Submitted	
LAUSD / QED / SCALE Science Leadership Meeting and 2005 Kick- off January 2005	1,3,5	X					Goal 1 and Goal 2 SCALE staff along with Faculty from CSU Dominguez Hills (QED grant award) presented to the LAUSD science leadership. Three potential directions for immersion units were presented based on the areas of need identified by LAUSD. An outcome of this meeting was the development of 2 LAUSD / CSUDH / CSU Northridge immersion unit development teams that include representatives from the LAUSD science team, STEM faculty from CSUDH and CSUN, education faculty from CSUDH, and SCALE / QED supported curriculum writers.
SCALE / QED Immersion Unit Overview / Kickoff January 18 – 20, 2005	1,3	X					This meeting set the stage for the partnership between the Quality Education Development (QED) grant awarded to CSUDH and LAUSD and SCALE around immersion unit development. Immersion units were showcased and the development protocols were presented. An outcome of this meeting was to establish every other week meetings at CSUDH to co-construct 2 immersion units for LAUSD and to provide professional development for the STEM faculty around curriculum development, professional development for teachers, assessment and teaching strategies in order to support their work within their pre-service classes and in-service district PD.
Goal 1 and Goal 2 IFL / SCALE National Disciplinary Literacy Institute January 2004	1,2,3	X					The science portion of this institute was designed to provide the four SCALE districts (and other IFL districts) with a foundation for DL science and immersion along with specific strategies and tools for professional development sessions back in their districts in order to continue to build capacity.
LAUSD Local District 1 Immersion Unit Trainings February 2005	1,2,3	X					Grade 4 and Grade 5 immersion unit workshops were presented to approximately thirty Science Lead Teachers in Local District 1 of LAUSD. Grade 4 was a continuation of the field test for the unit and Grade 5 was presented for the first time to initiate field testing.

**Exhibit 1: Goal Two Activity: Implementation Matrix (June 2004 – June 2005)**

Activity: As delineated in SCALE Strategic & Implementation Plans	MSP Key Feature: (See Appendix)	Progress to Date: (Check one; enter date where appropriate)					Brief explanation for changes where an activity has not been carried out as planned:
		Activity Carried Out as Planned	Activity Delayed	Activity Revised	Activity Eliminated	New Activity Submitted	
LAUSD / QED / SCALE Science Leadership Meeting and 2005 Kick- off January 2005	1,3,5	X					Goal 1 and Goal 2 SCALE staff along with Faculty from CSU Dominguez Hills (QED grant award) presented to the LAUSD science leadership. Three potential directions for immersion units were presented based on the areas of need identified by LAUSD. An outcome of this meeting was the development of 2 LAUSD / CSUDH / CSU Northridge immersion unit development teams that include representatives from the LAUSD science team, STEM faculty from CSUDH and CSUN, education faculty from CSUDH, and SCALE / QED supported curriculum writers.
LAUSD Grade 7 Immersion Unit Training / Research Study February 4-6, 2005	1,2,3,4	X					Thirty-five Grade 7 teachers were trained on the Grade 7 immersion unit to begin studying the implementation of immersion units in the district and implications of immersion units on student understanding. This training was facilitated by SCALE Goal 1 and Goal 2 leaders along with LAUSD science leadership.
LAUSD Local District 1 Immersion Unit Training March 2005	1,2,3	X					Approximately 100 teachers in Grade 4 and Grade 5 were trained in the immersion units. This training was organized by the local district as a potential model for rolling-out the PD development needed and providing continued support back at the school site by the Science Lead teachers who were trained in February.
MMSD Grade 4 Immersion unit Training March 2005	1,2,3	X					Approximately 20 teachers were trained on the newly co-constructed Grade 4 immersion unit for field testing in the spring of 2005. The outcomes of this Institute have lead to classroom observations and implementation studies under Goal 5 of SCALE.
Goal 2 and Goal 5 Immersion Unit Research and Evaluation Meeting March 28, 2005	1,4	X					The Goal 2 leadership met with the research and evaluation leadership to identify the targeted needs of the immersion unit development teams as well as to begin to outline potential targeted studies around professional development, implementation and student achievement.

**Exhibit 1: Goal Two Activity: Implementation Matrix (June 2004 – June 2005)**

<b>Activity:</b> As delineated in SCALE Strategic & Implementation Plans	<b>MSP Key Feature:</b> (See Appendix)	<b>Progress to Date:</b> (Check one; enter date where appropriate)					<b>Brief explanation for changes where an activity has not been carried out as planned:</b>
		<i>Activity Carried Out as Planned</i>	<i>Activity Delayed</i>	<i>Activity Revised</i>	<i>Activity Eliminated</i>	<i>New Activity Submitted</i>	
MMSD Scope and Sequence Review Committee Meeting April 2005	1,3,5	X					The last of 6 meetings was held to revise the K-8 Scope and Sequence for MMSD. Representatives from the immersion unit development teams worked with the district teachers and leadership on the committee to provide additional support and to integrate the concept of immersion into the planning.
DPS Science Teacher Leadership Institute April 2005	1,2,3	X					Goal 2 leadership assisted in the facilitation of this institute and provided an introduction to the immersion units and potential units that would align with the DPS standards.
LAUSD Immersion Teacher Focus Groups April 2005	1,2,4	X					Four focus groups were held for LAUSD teachers in order to continue to elicit feedback on the professional development, implementation and district support of immersion units. Both implementer and non- implementer sessions were held.
MMSD Kindergarten Immersion Unit Training May 6, 2005	1,2,3	X					Approximately 20 teachers were trained on the newly co-constructed Kindergarten immersion unit for field testing in spring of 2005. Outcomes of this institute have lead to classroom observations and implementation studies under Goal 5 of SCALE.
Goal 2 and Goal 1 LAUSD Science Leadership Institute May 18-19, 2005	1,2,3,5	X					This two day institute brought together all of the LAUSD K-12 science leadership (approximately 35 participants) for a common experience and vision for science in the district. This was the first of 3 institutes planned for this team.
QED / SCALE / LAUSD Summer Science Institutes Planning Institute May 24-25, 2005	1,2,3	X					The purpose of this institute was to co-develop the week long immersion unit institutes for LAUSD 4, 6, 7, and 8 grade teachers. The institutes will be presented by representatives of the immersion unit development teams from CSUDH, CSUN, LAUSD, and UW- Madison. There will be three Grade 4 institutes, two Grade 6 institutes and one Grade 7 and 8 institute over the course of the summer.

**Exhibit 1: Goal Three Activity: Implementation Matrix (June 2004 – June 2005)**

<b>Activity:</b> As delineated in SCALE Strategic & Implementation Plans	<b>MSP Key Feature:</b> (See Appendix)	<b>Progress to Date:</b> (Check one; enter date where appropriate)					<b>Brief explanation for changes where an activity has not been carried out as planned:</b>
		<i>Activity Carried Out as Planned</i>	<i>Activity Delayed</i>	<i>Activity Revised</i>	<i>Activity Eliminated</i>	<i>New Activity Submitted</i>	
CSUDH Summer Math Institute July 5-19, 2004	2	X					Video documentation of this activity has been developed by SCALE. This activity has also formed the basis of additional math and science Institutes to be held at CSUDH and CSUN in July and August 2005.
Education Partnership Conference March 11-12, 2005	1,2,3,4,5	X					The EPC was our 2005 IHE conference, which featured the MSP Five Key Features. More than 145 K-12 administrators and teachers, STEM and Ed faculty, IHE researchers, and others attended the event.
Math Masters Modular 1 credit courses – UW and MMSD	2	X					The first year of courses have been completed. An additional grant was applied for and awarded, expanding the number of courses and teachers enrolled for the 2005-06 school year.
University of Pittsburgh Biology, Physics and Chemistry courses to attract undergraduates to K-12 teaching careers, Spring semester 2004- 2005	2	X					
Submission of TQE grants – summer 2004							CSUDH STEM and Education faculty collaborated with UW-Madison SCALE members to write and win a US DOE TQE proposal and a CaMSP proposal.
TQE-D and QED kick-off meetings in Denver, Los Angeles and Phoenix	1,2,3,4,5	X On-going					SCALE members from UW-Madison, University of Pittsburgh, CSUDH, Denver Public Schools, and LAUSD are working in collaboration with these 2 US DOE grants.

**Exhibit 1: Goal Three Activity: Implementation Matrix (June 2004 – June 2005)**

<b>Activity:</b> As delineated in SCALE Strategic & Implementation Plans	<b>MSP Key Feature:</b> (See Appendix)	<b>Progress to Date:</b> (Check one; enter date where appropriate)					<b>Brief explanation for changes where an activity has not been carried out as planned:</b>
		<i>Activity Carried Out as Planned</i>	<i>Activity Delayed</i>	<i>Activity Revised</i>	<i>Activity Eliminated</i>	<i>New Activity Submitted</i>	
CSUDH Summer Math Institute July 5-19, 2004	2	X					Video documentation of this activity has been developed by SCALE. This activity has also formed the basis of additional math and science Institutes to be held at CSUDH and CSUN in July and August 2005.
Education Partnership Conference March 11-12, 2005	1,2,3,4,5	X					The EPC was our 2005 IHE conference, which featured the MSP Five Key Features. More than 145 K-12 administrators and teachers, STEM and Ed faculty, IHE researchers, and others attended the event.
Math Masters Modular 1 credit courses – UW and MMSD	2	X					The first year of courses have been completed. An additional grant was applied for and awarded, expanding the number of courses and teachers enrolled for the 2005-6 school year.
University of Pittsburgh Biology, Physics and Chemistry courses to attract undergraduates to K-12 teaching careers, Spring semester 2004- 2005	2	X					
UW, CSUDH and LAUSD coordination of PD for Elementary Immersion	1,2,3,4,5	X On-going					SCALE Goal 3 and Goal 2 are working in partnership with CSUDH, CSUN and LAUSD to develop elementary immersion units and provide in-service development and support for immersion implementation in the elementary classroom.
QED/SCALE Summer Science Institutes	1,2,3,4,5						The science Institutes are scheduled to take place July and August for grade 4, 6, 7, and 8 teachers
QED/SCALE Summer Math Institutes	1,2,3,4,5						The math Institutes are scheduled to take place in July, for middle school teachers

**Exhibit 1: Goal Three Activity: Implementation Matrix (June 2004 – June 2005)**

<b>Activity:</b> As delineated in SCALE Strategic & Implementation Plans	<b>MSP Key Feature:</b> (See Appendix)	<b>Progress to Date:</b> (Check one; enter date where appropriate)					<b>Brief explanation for changes where an activity has not been carried out as planned:</b>
		<i>Activity Carried Out as Planned</i>	<i>Activity Delayed</i>	<i>Activity Revised</i>	<i>Activity Eliminated</i>	<i>New Activity Submitted</i>	
Bi weekly SCALE QED middle school science immersion co-construction development meetings with CSUDH STEM and SOE Faculty, and LAUSD K-12 science experts	1,2,3 and 5  January 20- May 31	X					These meetings have culminated in the development of two new immersion units and the revision of two immersion units. The immersion units will be pilot tested with teachers form LAUSD in the CSUDH and CSUN Summer Institutes in July and August.

**Exhibit 1: Goal Four Activity: Implementation Matrix (June 2004 – June 2005)**

Activity: As delineated in SCALE Strategic & Implementation Plans	MSP Key Feature: (See Appendix)	Progress to Date: (Check one; enter date where appropriate)					Brief explanation for changes where an activity has not been carried out as planned:
		Activity Carried Out as Planned	Activity Delayed	Activity Revised	Activity Eliminated	New Activity Submitted	
Conduct a literature survey and review of federal and private foundation supported programs. Determine how these funded programs complement the SCALE initiative.	4			X			This activity is being conducted within the framework of the needs analyses currently underway along with the identification of equity improvement areas.
Investigate active district level equity strategies and determine how these strategies should be incorporated into the other three goals and how best practices may be shared across districts.	1	X in-progress					This activity has been carried out in all but one district, LAUSD.
Conduct a think-tank on equity.	1		X				After consideration of current activities in Goal 4, it was felt that this activity would be pre-mature until there was significant progress in each of the districts. This activity will be pursued during the summer of year four.
Write a summary report on the expected utility of each of the identified district strategies and federally/privately funded initiatives from the perspective of SCALE's goals and the district's capabilities.	4	X in-progress					This activity is being conducted with respect to the needs assessment and individual district mini-retreats/planning sessions.

**Exhibit 1: Goal Four Activity: Implementation Matrix (June 2004 – June 2005)**

<b>Activity:</b> As delineated in SCALE Strategic & Implementation Plans	<b>MSP Key Feature:</b> (See Appendix)	<b>Progress to Date:</b> (Check one; enter date where appropriate)					<b>Brief explanation for changes where an activity has not been carried out as planned:</b>
		<i>Activity Carried Out as Planned</i>	<i>Activity Delayed</i>	<i>Activity Revised</i>	<i>Activity Eliminated</i>	<i>New Activity Submitted</i>	
Use Schofield's 2001 report "Diversity within Unity: Essential Principles for Teaching and Learning in a Multicultural Society" as a thematic base to create initial equity benchmarks that are integrated with the other three goals of SCALE.	4	X					This report along with several other literature based resources were used to develop a common framework to use in the districts to discuss issues of equity and metrics which lead to benchmarks.
Have benchmarks reviewed and revised by SMT goal leaders and district managers.	1	X					This was conducted at the 2005 NAB
Meet with the Equity Council to review and enhance equity benchmarks.	1				X		During the past year the opportunity to bring 12 (in reality many more) members together was deemed a problematic task. Rather, a smaller equity mentor group will be formed in the upcoming year to review and provide feedback on progress. It is highly likely that many of the people on the Council of 12 will remain on the smaller group.
Determine significant metrics and potential impact on closing the equity gap through analysis of national databases.	4	X in-progress					A math model is being developed from the National Education Longitudinal Study of 1988 (NELS:88) to identify strategies and their impact on the math performance of students. The model will be utilized to make suggestions for specific racial and economic groups that may lead to the reduction of the mathematics achievement gap. The model and subsequent analysis is slated for completion by end of summer 2005.

**Exhibit 1: Goal Four Activity: Implementation Matrix (June 2004 – June 2005)**

Activity: As delineated in SCALE Strategic & Implementation Plans	MSP Key Feature: (See Appendix)	Progress to Date: (Check one; enter date where appropriate)					Brief explanation for changes where an activity has not been carried out as planned:
		Activity Carried Out as Planned	Activity Delayed	Activity Revised	Activity Eliminated	New Activity Submitted	
Work with Norm Webb to determine feasible metrics for monitoring equity benchmarks in the SCALE indicator system.	1	X in-progress					During the past winter, a meeting was held with N. Webb to review the indicator system progress and how the district equity benchmarks can be interwoven. As progress continues on the districts' use of the benchmarks these may be integrated into the indicator system.
Determine baseline values for equity benchmarks and specific-district appropriate and approved targets.	4	X in-progress					Two of the four districts have a system for tracking equity benchmarks and have established internal baselines. In DPS, because benchmarks do not yet exist this will be a target activity during the summer 2005. As mentioned, LAUSD will be investigated in the fall 2005.
Establish a purposeful process for monitoring each benchmark such that equity improvements are properly documented by SCALE and the districts.	5	X in-progress					See above.
Determine across the districts areas for improvement with respect to equity.	4	X in-progress					In three of the four districts extensive interviews and retreats have been conducted. The purpose of the retreats is to establish areas for improvement in each district by identifying successful strategies and how SCALE resources can be properly allocated to the district to implement the targeted strategies.
For upcoming district immersion units provide guidance to ensure equity issues are addressed, measured and documented.					X		Goal 2 research has allowed this activity to be minimized.
Working with the Goal 1 team, establish a systems-based approach to equity in the districts.						X	See above.

**Exhibit 1: Goal Four Activity: Implementation Matrix (June 2004 – June 2005)**

<b>Activity:</b> As delineated in SCALE Strategic & Implementation Plans	<b>MSP Key Feature:</b> (See Appendix)	<b>Progress to Date:</b> (Check one; enter date where appropriate)					<b>Brief explanation for changes where an activity has not been carried out as planned:</b>
		<i>Activity Carried Out as Planned</i>	<i>Activity Delayed</i>	<i>Activity Revised</i>	<i>Activity Eliminated</i>	<i>New Activity Submitted</i>	
Investigate attitudinal issues related to students entering higher education and their decision to study STEM or non-STEM fields.						X	See above.

## Appendix: Math & Science Partnership 5 Key Features

1. **Partnership-Driven** – [MSP] projects partner disciplinary faculty in mathematics, the sciences and/or engineering, education faculty and administrators in higher education with administrators, teachers and guidance counselors in participating K-12 core partner organizations. These Partnerships draw upon the disciplinary expertise of faculty in mathematics, the sciences and/or engineering, undergraduate students (including pre-service), graduate students, and postdoctoral candidates in the higher education core partner organizations, and link these individuals with in-service teachers, administrators and guidance counselors in K-12 core partner organizations. Scientists, mathematicians, engineers and individuals from other core and supporting partner organizations may also play significant roles in project activities. Core partners are deeply engaged in the effort at both the institutional and individual levels, and share goals, responsibilities and accountability for the project.
2. **Teacher Quality, Quantity and Diversity** – Partnerships enhance and sustain the quality, quantity and diversity of K-12 teachers of mathematics and/or the sciences. Drawing upon the expertise of scientists, mathematicians and/or engineers in partner organizations, pre-service students and in-service K-12 teachers are engaged in the development of strong mathematics and/or science content knowledge and related pedagogical methods and skills, including the effective use of technology in the teaching of mathematics and/or the sciences. These activities support the challenging courses and curricula implemented in the K-12 core partner organizations. Partnerships also develop and apply innovative strategies for: increasing the diversity of the K-12 teacher workforce; recruiting qualified individuals to the teaching profession; influencing the teacher certification process; providing for the effective induction of new teachers; establishing policies and procedures that appropriately impact teacher qualification requirements and placement; and/or increasing teacher retention rates. Projects ensure that K-20 educators develop the knowledge and skills necessary to effectively match local and state standards with challenging courses and curricula, instructional strategies, learning technologies and assessments.
3. **Challenging Courses and Curricula** – Partnerships ensure that K-12 students are prepared for, have access to and are encouraged to participate and succeed in challenging mathematics and/or science courses and curricula. Challenging coursework enables all students to develop a deeper understanding of mathematics and/or the sciences. Innovative approaches integrate a mastery of fundamentals with the more sophisticated conceptual understandings essential to improve student achievement in mathematics and the sciences, drawing – where appropriate – upon computer-communications technology and contemporary research on the science of learning to enhance student and teacher access and performance. Challenging courses and curricula are aligned with State mathematics and science student academic achievement standards, resulting in a greater number of students participating and succeeding in advanced courses. Projects ensure that K-12 students develop sufficient depth and breadth of content knowledge, skills and ways of thinking to allow them to apply the mathematics and/or science knowledge and skills acquired throughout life.
4. **Evidence-Based Design and Outcomes** – Project design is informed by current research and studies on learning and teaching. Project outcomes make evidence-based contributions to the learning and teaching knowledge base, so that research findings and successful evidence-based strategies can be broadly disseminated to improve educational practice. Projects also link assessment (classroom, local and state) and accountability measures. Collected data include both student and teacher indicators in mathematics and/or the sciences; and are disaggregated by race, ethnicity, socio-economic status, gender and disability. Indicators that measure the effectiveness of the Partnership; the impact of the contributions made by faculty in the sciences, mathematics and/or engineering; the effect of new

## **Appendix: Math & Science Partnership 5 Key Features**

institutional policies and practices; and other important factors are developed, collected and analyzed to inform the continuous refinement of the project.

5. **Institutional Change and Sustainability** – To ensure project sustainability, K-20 core partner organizations redirect resources and design and implement new policies and practices to result in well-documented, inclusive and coordinated institutional change at both the college/university and the local school district level. Higher education core partners reward faculty in mathematics, the sciences and/or engineering for strengthening their own teaching practices and for their work in K-20 mathematics and science education, including K-12 teacher preparation and professional development. K-12 core partner organizations create and sustain an environment that values an evidence-based approach and that recognizes and rewards significant contributions to improved mathematics and science learning and teaching. Other core partners commit to engaging mathematicians, scientists and/or engineers and other individuals in activities that strengthen their roles in K-12 mathematics and science education for the long-term.

## **Appendix 3: Benchmark Matrix**

The Goal Benchmark Matrix is designed to help organize objectives and benchmarks—by project goal—in a consistent manner over the life of the project. Each goal is identified (the same goals used in Appendix 2 for project activities, and are the goals delineated in the Strategic Plan) and the corresponding benchmarks that were to be attained for that goal in the past year. A brief narrative that further describes the status of reaching the benchmark (e.g., evidence that a benchmark was met, year in which the benchmark is expected to be fully achieved) is included.

**Exhibit 2: Goal One Activity: Benchmark Matrix (June 2004 – June 2005)**

<b>Benchmark:</b> (See details following matrix)	<b>Level of Attainment:</b> (Check one; enter date where appropriate)					<b>Brief Explanation for Revisions, New Benchmarks, and Target Dates:</b>
	<i>Benchmark Met</i>	<i>Benchmark Not Met</i>	<i>Target Year Revised</i>	<i>Benchmark Revised</i>	<i>No Longer a Project Benchmark</i>	
<b>1a-1</b>	X					SCALE produced a concept paper that outlines these criteria in each district. The paper entitled “ <i>The SCALE Teaching and Monitoring Systems: An Analytic Guide for District Planning.</i> ” was written by Dr. Lauren Resnick and distributed to each of the SCALE districts.
<b>1a-2</b>	X					Throughout the summer and fall of 2004, each district (except Madison) met to in “retreat” mode to review the paper and propose a timeline for adopting policies. A meeting was schedule for Madison but was postponed and will be rescheduled based on the district’s availability.
<b>1a-3</b>	X					This is the “systems” rubrics. The <i>SCALE Teaching and Monitoring System</i> concept paper includes a series of questions under each of its five components. These questions are designed to guide district thinking toward a coherent system. This document, along with the Fall 2004 Goal One In-District retreats and the IFL May 2005 Annual Retreat entitled “Ensuring Equity and Access: Designing Coherent Instructional Systems,” form the basis of the systems rubrics.
<b>1a-4</b>		Will be met on schedule 12/05				In subsequent years SCALE rubrics will be used to create annual reports on learning policy implementation.
<b>1a-5</b>	X					Each district has identified its middle school mathematics program. Denver, Madison and Providence all use the Connected Math Program. In LAUSD each local districts chooses one of three textbooks: 1) California Middle School Mathematics, Concepts and Skills; 2) California Mathematics; and 3) Harcourt Math. LAUSD also uses IFL conceptual lessons in professional development for teachers and coaches to supplement and support the districts textbook adoption and use of instructional guides.
<b>1a-6</b>	X					All SCALE districts have established a policy of teaching all students algebra by the 9 <sup>th</sup> grade or earlier.
<b>1a-7</b>		Will be met on schedule 12/05				By December 2005, all districts will have selected a rigorous elementary math program.

**Exhibit 2: Goal One Activity: Benchmark Matrix (June 2004 – June 2005)**

<b>Benchmark:</b> (See details following matrix)	<b>Level of Attainment:</b> (Check one; enter date where appropriate)					<b>Brief Explanation for Revisions, New Benchmarks, and Target Dates:</b>
	<i>Benchmark Met</i>	<i>Benchmark Not Met</i>	<i>Target Year Revised</i>	<i>Benchmark Revised</i>	<i>No Longer a Project Benchmark</i>	
<b>1a-8</b>		Will be met on schedule 12/06				By December 2006 a full sequence of high school math requirements will be defined in each district and will apply to all students. In year 3 Disciplinary Literacy (DL) will continue to provide LAUSD, DPS and PPS models of rigorous instruction that will help inform the decision making.
<b>1a-9</b>		Will be met on schedule 12/07				By December 2007 each district will have a coherent K-12 mathematics program for all students in place, with aligned systems of professional learning, monitoring and individual student adaptation.
<b>1b-1</b>	X					In Year 3 SCALE has conducted three cross-district events, including two 3-day IFL Institutes and the IFL Annual Retreat in May 2005.
<b>1b-2</b>	X					SCALE/IFL will begin phasing in the video benchmark in Year 3.
<b>2a-1</b>	X					All of the SCALE districts have outlined their plans and rollout schedule for recruiting and training mathematics and science instructional coaches and lead teachers.
<b>2a-2</b>		Will be met on schedule 12/05				SCALE districts will report on their progress in meeting these rollout schedules.
<b>2a-3</b>	X					In Year 2 the Professional Learning Rubrics were developed to address the quality of coaches and lead teachers in math and science. SCALE is currently revising and preparing to field test these rubrics in Fall 2005.
<b>2a-4</b>	X					The new SCALE Goal One district design teams will place a heavy emphasis on linking measures of professional learning community and other SCALE products to district improvement strategies. The professional learning, school leadership and systems rubrics are and will continue to be incorporated into district improvement strategies.
<b>2a-5</b>	X					Throughout the year coaches and lead teachers from each district participate in professional learning programs for math and science provided by DL Institutes and other SCALE/IFL events and in-district programs.

**Exhibit 2: Goal One Activity: Benchmark Matrix (June 2004 – June 2005)**

<b>Benchmark:</b> (See details following matrix)	<b>Level of Attainment:</b> (Check one; enter date where appropriate)					<b>Brief Explanation for Revisions, New Benchmarks, and Target Dates:</b>
	<i>Benchmark Met</i>	<i>Benchmark Not Met</i>	<i>Target Year Revised</i>	<i>Benchmark Revised</i>	<i>No Longer a Project Benchmark</i>	
<b>2b-1</b>	X					Throughout the year, SCALE through the IFL provides continual professional learning to principals and supervisors. In the past year, these have included two IFL Principal Think Tanks, where principals from three SCALE districts (DPS, LAUSD and PPS) helped to develop and pilot the School Leadership rubrics. It also included multiple in-district events. SCALE is working to schedule a PD session with Madison principals using the School Leadership rubrics in Fall 2005.
<b>2b-2</b>	X					UW-Madison Prof. Richard Halverson developed the School Leadership (Principal) Rubrics in September 2004. These rubrics have been administered and refined at two Principal Think Tanks and at a meeting of principals in Providence on May 5, 2005.
<b>2b-3</b>		Will be met on schedule 12/05 and each year following				In Year 3 and each succeeding year SCALE Goal One district design teams will work to incorporate School Leadership rubrics and other tools into district improvement strategies.
<b>2c-1</b>					X	In Year 2 Benchmark 2c-1 was delayed because measures were still under development. After consultation with LAUSD and the other SCALE districts, it was decided not to use separate measures for this benchmark because doing so was determined to be too intrusive and not beneficial to the districts. Professional learning community measures from Benchmark 2c-1 have been incorporated into the general rubric development.
<b>2c-2</b>					X	See above.
<b>2c-3</b>					X	See above.
<b>2d-1</b>	X					In the 2003-2004 school year, SCALE/IFL initiated coach and lead teacher training for inquiry in elementary and middle school science (FOSS kits) in at least two districts. High School Disciplinary Literacy work in science began in DPS, LAUSD and PPS, with a focus on two core topics in physics and biology.
<b>2d-2</b>	X					SCALE/IFL modified the DL plan after the first year of working on physics and biology and used a wider variety of shorter subject matter lessons from chemistry and biology. This year DPS was host to a set of three 2-day institutes that covered a wide range of science subject topics.

**Exhibit 2: Goal One Activity: Benchmark Matrix (June 2004 – June 2005)**

<b>Benchmark:</b> (See details following matrix)	<b>Level of Attainment:</b> (Check one; enter date where appropriate)					<b>Brief Explanation for Revisions, New Benchmarks, and Target Dates:</b>
	<i>Benchmark Met</i>	<i>Benchmark Not Met</i>	<i>Target Year Revised</i>	<i>Benchmark Revised</i>	<i>No Longer a Project Benchmark</i>	
<b>2d-3</b>		Will be met on schedule in SY 2005-06				
<b>2d-4</b>		Will be met on schedule in SY 2006-07				
<b>2e-1</b>					X	This benchmark was moved to Goal 3.
<b>2e-2</b>					X	This benchmark was moved to Goal 3.
<b>2e-3</b>					X	This benchmark was moved to Goal 3.
<b>2e-4</b>					X	This benchmark was moved to Goal 3.
<b>3a</b>	X					The monitoring system was covered in Dr. Resnick's concept paper, "Elements of a Coherent District-Wide Math and Science Teaching and Monitoring System."
<b>3b-1</b>	X					Each district has in place its planned interim monitoring system for mathematics and science.
<b>3b-2</b>	X					LAUSD, DPS and PPS, all have interim monitoring systems in place for mathematics grades K-8.
<b>3b-3</b>		Will be met on schedule 6/06				
<b>3b-4</b>		Will be met on schedule 6/07				
<b>3c-1</b>		Will be met in Years 3 & 4				Beginning in Years 3 and 4, the SCALE Goal One district design teams will work with each district to develop a consultant process that includes principals and their supervisors. The team will work with each district to help create a planning document that includes a regular review process between principals and their supervisors.
<b>3c-2</b>		Will be met on schedule 12/07				
<b>3c-3</b>		Will be met on schedule 6/06				
<b>3c-4</b>		Will be met on schedule 12/07				
<b>3c-5</b>		Will be met on schedule in 2010				

**Exhibit 2: Goal One Activity: Benchmark Matrix (June 2004 – June 2005)**

<b>Benchmark:</b> (See details following matrix)	<b>Level of Attainment:</b> (Check one; enter date where appropriate)					<b>Brief Explanation for Revisions, New Benchmarks, and Target Dates:</b>
	<i>Benchmark Met</i>	<i>Benchmark Not Met</i>	<i>Target Year Revised</i>	<i>Benchmark Revised</i>	<i>No Longer a Project Benchmark</i>	
<b>3d-1</b>	X					SCALE has developed the instruction assessments for math and will deliver an interim report on these assessments of teacher quality by the end of year 3 (December 2005). We have also collected limited validity data on the math rubrics in 2004-05 and will continue this work next year at the elementary level.
<b>3d-2</b>		Will be met on schedule 12/05				
<b>3d-3</b>		Will be met on schedule in Years 6-10				
<b>4a</b>		X				This benchmark has not yet been met. Issues around the use of state accountability systems to improve student achievement will be addressed in the work of the SCALE Goal One district design teams in Years 3 and 4.
<b>4b-1</b>		X				SCALE Goal One is planning to use the Quality Indicator System to address this benchmark.
<b>4c-1</b>		Will be met on schedule 12/05				
<b>4d-1</b>		Will be met on schedule 12/05				We expect to meet this benchmark on schedule by December 2005. However 2 SCALE districts are going through leadership transitions which may delay the full adoption of H.S. requirements.
<b>4d-2</b>		Will be met on schedule in SY 2007-08				
<b>4d-3</b>		Will be met on schedule 12/08				
<b>4e-1</b>	X					Each SCALE district has specified its intended system for identifying and supporting “weak” schools. (See SCALE report “Quantitative Data Reports” from the NSF Site Visit, June 2004)
<b>4e-2</b>	X					LAUSD, DPS and PPS have in place their intended systems for identifying and supporting “weak” schools. For more information on the systems see the attached document entitled <i>SCALE Districts Weak Schools Plan</i> .
<b>4e-3</b>		Will be met on schedule 12/06				

**Exhibit 2: Goal One Activity: Benchmark Matrix (June 2004 – June 2005)**

<b>Benchmark:</b> (See details following matrix)	<b>Level of Attainment:</b> (Check one; enter date where appropriate)					<b>Brief Explanation for Revisions, New Benchmarks, and Target Dates:</b>
	<i>Benchmark Met</i>	<i>Benchmark Not Met</i>	<i>Target Year Revised</i>	<i>Benchmark Revised</i>	<i>No Longer a Project Benchmark</i>	
<b>4e-4</b>		Will be met on schedule 12/08				

**Goal One Benchmarks**

**The Teaching Dimension: Defined math and science curricula and tools for monitoring their implementation.**

**Benchmark 1a-1.** SCALE will produce a concept paper outlining criteria for all of the components of district math and science teaching programs that each district will address.

**Benchmark 1a-2.** Each district will make commitments to a timeline for adoption of policies with respect to each of the agreed-upon components.

**Benchmark 1a-3.** SCALE will develop a set of rubrics for describing the progress that each district (and school, where appropriate) is making toward implementing its policies.

**Benchmark 1a-4.** In subsequent years, annual reports on learning policy implementation will be made using these rubrics.

**Benchmark 1a-5.** By December 2003, each district will have identified its middle school mathematics program.

**Benchmark 1a-6.** By December 2004 all districts will establish a policy of teaching all students algebra (or the first year of a rigorous integrated mathematics program) by at least the 9<sup>th</sup> grade.

**Benchmark 1a-7.** By December 2005, all districts will have selected a rigorous elementary mathematics program.

**Benchmark 1a-8.** By December 2006 a full sequence of high school mathematics requirements will be defined in each district; these requirements will apply to all students.

**Benchmark 1a-9.** By December 2007 each district will have a coherent K-12 mathematics program for all students in place, with an aligned system of professional learning, monitoring and individual student adaptation.

**The Teaching Dimension: Developing shared visions of and standards for effective math and science teaching.**

**Benchmark 1b-1.** During each of the first three years of SCALE, we will conduct at least two cross-district events in which teachers, coaches and others from the districts will have the opportunity to consider together examples of high quality instruction in math and science and to discuss criteria used in making judgments of quality.

**Benchmark 1b-2.** Each year we will collect multiple video examples of mathematics and science teaching in SCALE districts and other high performance sites. These will be used to develop and illustrate shared criteria of instructional quality.

**The Professional Learning Dimension: Development of coaches and lead teachers in mathematics and science**

**Benchmark 2a-1.** Each SCALE district will outline its plan and rollout schedule for recruiting and selecting math and science instructional coaches/lead teachers/instructional specialists and its plans for training and supporting them.

## **Exhibit 2: Goal One Activity: Benchmark Matrix (June 2004 – June 2005)**

**Benchmark 2a-2.** In each succeeding year each district will report on its progress in meeting its rollout schedule.

**Benchmark 2a-3.** By December 2004, SCALE will develop tools, including rubrics for assessing the quality of coaches and lead teachers in mathematics and science.

**Benchmark 2a-4.** These tools and rubrics, which will be linked to the measures of professional community described below and will include role definitions for coaches/lead teachers or other designated personnel, will be incorporated into district improvement strategies and used in each succeeding year to provide an assessment of the quality of the work of lead teachers, coaches, and instructional specialists.

**Benchmark 2a-5.** Coaches and lead teachers from each district will participate yearly in professional learning programs for mathematics and science provided by the IFL through its Disciplinary Literacy courses and on-site programs.

### **The Professional Learning Dimension: Professional learning for principals and supervisors**

**Benchmark 2b-1.** Principals and supervisors from each district will participate yearly in professional learning programs for mathematics and science provided by the Institute for Learning and district leadership.

**Benchmark 2b-2.** By December 2004, the SCALE partnership will develop tools, including rubrics for assessing the quality of principals and supervisors as instructional leaders in mathematics and science.

**Benchmark 2b-3.** The tools in Benchmark 2b-2 will be incorporated into district improvement strategies and used in each succeeding year to provide an assessment of the quality of the work of principals and supervisors.

### **The Professional Learning Dimension: Professional learning communities within schools**

Benchmark 2c-1. During the 2003-4 school year and in each successive year districts will use selected measures of professional learning communities to inform changes in their professional learning system.

Benchmark 2c-2. During the 2004-5 school year and in each successive year, we will supplement the initial measure of professional learning communities with SCALE-developed rubrics, which will include assessments of the evidence of math and science coaching as a source of instructional improvement.

Benchmark 2c-3. We expect a rising percent of schools in each SCALE district to show high levels of implementation of professional learning communities (i.e., they will be rated at Level 3 or 4 on a 4-point rubric): 10% in Year 2, 20% in Year 3, 30% in Year 4, 40% in Year 5. We expect the school professional community implementation level to be correlated with gains in student performance in math and science and with quality of instruction, and will report on the degree of correlation.

### **The Professional Learning Dimension: SCALE professional learning programs for science**

**Benchmark 2d-1.** During the 2003-2004 school year, we will initiate coach and lead teacher training for inquiry elementary and middle school science (FOSS kits) in at least two districts. High school Disciplinary Literacy work in science will begin in all districts, with a focus on two core topics in physics and biology.

**Benchmark 2d-2.** During the 2004-2005 school year, high school disciplinary literacy will be extended to include two additional topics in physics and biology. Middle school Disciplinary Literacy will begin, with a focus on physical sciences and biology.

**Benchmark 2d-3.** During the 2005-6 school year, high school literacy will be extended to chemistry and middle school Disciplinary Literacy will be extended to two further topics.

**Exhibit 2: Goal One Activity: Benchmark Matrix (June 2004 – June 2005)**

**Benchmark 2d-4.** During the 2006-7 school year the disciplinary literacy professional system will be extended to meet needs identified by the monitoring system.

**The Professional Learning Dimension: Induction and support programs for novice teachers**

**Benchmark 2e-1.** An annual fall conference of the local IHEs involved in SCALE, together with appropriate district representatives, will be the occasion for the IHEs and districts to create plans, review results of the previous years work, and confer with colleagues in other SCALE cities. Annual reports resulting from these conferences will be submitted to NSF.

**Benchmark 2e-2.** Pre-service and induction programs based on SCALE professional learning programs will be introduced in at least one district during the 2003-2004 school year.

**Benchmark 2e-3.** Pre-service and induction programs based on SCALE professional learning programs will be introduced in at least two additional districts during the 2004-5 school year.

**Benchmark 2e-4.** Pre-service and induction programs based on SCALE professional learning programs will be introduced in all SCALE districts during the 2005-6 school year.

**The Monitoring Dimension**

**Benchmark 3a.** SCALE will prepare an analytic paper on district systems for monitoring by December 2003.

**The Monitoring Dimension: Interim assessments of student achievement.**

**Benchmark 3b-1.** This benchmark will be met by SCALE districts in three phases. No later than June 30, 2004, each district will specify its planned interim monitoring system for mathematics and science.

**Benchmark 3b-2.** One year later—by June, 2005—each district will have mounted its interim monitoring system for mathematics grades K-8.

**Benchmark 3b-3.** By June, 2006 each district will have mounted its interim monitoring system for science K-8.

**Benchmark 3b-4.** By June 2007, each district will have mounted its interim monitoring system for high school mathematics and science.

**The Monitoring Dimension: School and classroom improvement plans, with personalized, regular review of progress toward plans**

**Benchmark 3c-1.** By June 2004, each district will have agreed in a consultative process that includes principals and their supervisors upon a school planning document and a regular review process (several times per year) between principal and supervisor.

**Benchmark 3c-2.** By the end of Year 5, all principals in the district will be participating in this continuous improvement.

**Benchmark 3c-3.** By June 2006, all districts will have developed—in consultation with teachers—a plan and process for engaging teachers in regular reviews of benchmarks and student progress for personalized regular review of student progress with individual teachers.

**Benchmark 3c-4.** At least a quarter of teachers in each district will be participating in the review process by the end of the fifth year of the grant (December, 2007).

**Benchmark 3c-5.** All teachers will be participating by 2010.

## **Exhibit 2: Goal One Activity: Benchmark Matrix (June 2004 – June 2005)**

### **The Monitoring Dimension: Monitoring teaching quality**

Benchmark 3d-1. We will deliver an interim report on assessments of teaching quality at the end of Year 3.

Benchmark 3d-2. We will have field-tested assessments of teaching quality ready for use in all SCALE districts by the end of Year 5.

Benchmark 3d-3. In Years 6-10, these assessments will come into regular use in all of the districts.

### **The Accountability Dimension**

Benchmark 4a. SCALE will prepare an analytic paper on the role of districts in using state accountability systems to improve student achievement in math and science by December 2004.

### **The Accountability Dimension: Student Achievement**

#### *Benchmark 4b-1*

K-8 Mathematics: Proportion of students at proficiency levels:

1. 2002-2003 Baseline
2. 2003-2004 target: 5% increase at each proficiency level
3. 2004-2005 target: 5% increase at each proficiency level
4. 2005-2006 target: 5% increase at each proficiency level
5. 2006-2007 target: 5% increase at each proficiency level

High School Mathematics:

1. 2002-2003 Baseline
2. 2004-2005 target: 5% increase at each proficiency level
3. 2006-2007 target: 5% increase at each proficiency level

### **The Accountability Dimension: Tests/assessments.**

**Benchmark 4c-1.** This benchmark will be met by each district no later than December, 2005—the year by which all states are required by NCLB to have implemented their assessment systems. Some districts will be able to meet the requirement earlier. We will report on the status in each district annually.

### **The Accountability Dimension: Graduation requirements**

**Benchmark 4d-1.** This benchmark will be met by districts in two phases. By the end of year 3 (December, 2005) districts will have adopted their intended high school requirements, with community and school board approval.

**Benchmark 4d-2.** By school year 2007-8), all 9<sup>th</sup> and 10<sup>th</sup> grade students will be taking courses in accord with the specified requirements.

**Benchmark 4d-3.** By the end of Year 7 (December 2008), graduation will depend upon meeting the adopted requirements, and necessary “catch-up” programs for low-performing students will be in place.

### **The Accountability Dimension: Weak school identification and support system**

**Exhibit 2:** *Goal One Activity: Benchmark Matrix (June 2004 – June 2005)*

Benchmark 4e-1. Each SCALE district will specify its intended system for identifying and supporting weak schools no later than March 2004.

Benchmark 4e-2. Each SCALE district will begin implementation of its intended system for identifying and supporting weak schools no later than school year 2004-5.

Benchmark 4e-3. By December 2006, it is expected that at least 20% of schools will have received assistance and support under the system.

**Benchmark 4e-4.** By December 2008, we expect 10% of schools in each district to have shown substantial improvement (resulting in their removal from the “weak school” category) in students’ math and science achievement as a result of the district’s weak school identification and support system.

**Exhibit 2: Goal Two Activity: Benchmark Matrix (June 2004 – June 2005)**

<b>Benchmark:</b> (See details following matrix)	<b>Level of Attainment:</b> (Check one; enter date where appropriate)					<b>Brief Explanation for Revisions, New Benchmarks, and Target Dates:</b>
	<b>Benchmark Met</b>	<b>Benchmark Not Met</b>	<b>Target Year Revised</b>	<b>Benchmark Revised</b>	<b>No Longer a Project Benchmark</b>	
<b>5a-1</b>	X					Concept papers for both Math and Science have been written and are currently being updated due to modifications in our approaches to our work. Science was completed in 2004 and Math completed in 2005.
<b>5a-2</b>	X					This will continue through SCALE's entire term.
<b>5b-1</b>	X					This benchmark was met in 2003. During the 2004-2005 year the cohort one and two model for immersion unit development no longer exists due to the new method of identifying the concepts for immersion units and the co-construction with district personnel, STEM and education faculty and SCALE personnel at the local level integrated with other SCALE goals.
<b>5b-2</b>				X		This benchmark was met in 2003-2004 We have exceeded this by co-constructing 5 units during the 2004-2005 time period and have initiated field-testing and revisions for 3 of the 5.
<b>5c-1</b>	X					Continues to be updated based on new information in light of our current work in SCALE districts. The work of the immersion unit team has integrated into the Goals 1 and 3 initiatives by developing coherent district and IHE plans for development, professional development, and implementation of the units.
<b>5c-2</b>	X					This benchmark was met in 2004 and continues to be updated and revised to showcase the co-construction of the units with the Immersion unit advisory teams based on our on-going work in the districts, the local IHEs and continued integration with the other SCALE goals.
<b>5c-3</b>	X					For completed immersion units, a facilitators guide for professional development has been produced for various workshop schedules and professional development module session have been developed to support key aspects of immersion unit implementation to integrate into the work of Goals 1 and 3.
<b>6a-1</b>		X				SCALE immersion has not been working in all districts. We have focused our efforts on LAUSD and MMSD. 3 Immersion units were piloted and implementation was informally evaluated through multiple teacher focus groups and one unit is currently under evaluation in collaboration with the research and evaluation group in LAUSD (PERB) and the Goal 5 team of SCALE. 2 additional units are currently being evaluated for teacher implementation in MMSD through Goal 5. Training plans for LAUSD and MMSD have been developed and implemented.

**Exhibit 2: Goal Two Activity: Benchmark Matrix (June 2004 – June 2005)**

<b>Benchmark:</b> (See details following matrix)	<b>Level of Attainment:</b> (Check one; enter date where appropriate)					<b>Brief Explanation for Revisions, New Benchmarks, and Target Dates:</b>
	<b>Benchmark Met</b>	<b>Benchmark Not Met</b>	<b>Target Year Revised</b>	<b>Benchmark Revised</b>	<b>No Longer a Project Benchmark</b>	
<b>6a-2</b>			X			<p>This benchmark has not been met in all SCALE districts.</p> <p>The focus of our efforts have been in LAUSD and MMSD where this benchmark has been met We are revising this date to the 2005-2006 year for Denver and it is unknown at this point for Providence.</p>
<b>6a-3</b>			X			<p>Only LAUSD and MMSD have developed and committed to the timelines in Goal 2.</p> <p>Due to the move towards the development of the additional immersion units in collaboration with Goal 1 and Goal 3 initiatives the web page development has been set aside and will be revisited during the 2005-2006 year. This development will be centered on the need for on-going professional development for the teachers implementing the units.</p>
<b>6a-4</b>			X			<p>This benchmark has not been met for all SCALE districts. Our work has focused on LAUSD and MMSD and Pittsburgh. In LAUSD we are currently piloting and evaluating 5 immersion units. In MMSD and Pittsburgh we are currently piloting and evaluating 2 immersion units. Denver piloting is expected to begin during the 2005-2006 year and Providence is unknown.</p>
<b>6a-5</b>			X			<p>This benchmark is being revised for 2005-2006. LAUSD and MMSD are implementing more than one unit. LAUSD has focused on Grades 4-8, one at each grade.</p>
<b>6a-6</b>			X			<p>Target date has revised to year 5 of SCALE (2006-2007) due to complexities of adoption and implementation of immersion units and the overall system support in two of the SCALE districts.</p>
<b>6a-7</b>			X			<p>This benchmark may not be met across all SCALE districts and will be reevaluated during thee 2005-2006 year.</p> <p>The library of immersion resources and templates will be available by December 2007.</p>
<b>7a-1</b>			X Spring 2005			<p>The immersion unit team has worked with LAUSD and MMSD to move this work forward. The Immersion Units implementation has been aligned with the overall district plans for science including professional development and monitoring and accountability systems.</p>

**Exhibit 2: Goal Two Activity: Benchmark Matrix (June 2004 – June 2005)**

**Goal Two Benchmarks**

**Define, Identify, and Develop Immersion Unit Resources**

**Benchmark 5a-1** Concept paper specifying criteria for and role of model immersion units in math/science district curricula

**Benchmark 5a-2** Revise and supplement concept paper

**Benchmark 5b-1** Identify 2 Cohort 1 immersion resources for testing and piloting; identify 3 Cohort 2 units for selective testing

**Benchmark 5b-2** Identify, develop, pilot, and evaluate 1-3 new immersion resources at different grade levels for math and science

**Create Professional Learning Materials for the Immersion Units**

**Benchmark 5c-1** Concept paper specifying integration of immersion units into district math/science curricula

**Benchmark 5c-2** Establish criteria and formulate design for immersion units

**Benchmark 5c-3** Produce professional development materials for 5c-2 immersion units

**Implement and Evaluate Immersion Units**

**Benchmark 6a-1** Pilot and evaluate 2 Cohort 1 immersion units in LA; outline recruiting and training plan and 2004 schedule for LA's Cohort 1 immersion units. Pilot Cohort 2 immersion resources in all districts

**Benchmark 6a-2** Produce implementation timeline for Cohort 1 immersion units and coach/lead teacher training in all districts for 2004/05 year

**Benchmark 6a-3** Districts will commit to 6a-2 timeline; SCALE will develop district immersion web pages

**Benchmark 6a-4** Pilot and evaluate 1-3 immersion units at different grade levels in all districts; in 1 district, test 2 sequenced (i.e., at 2 grade levels) sets of immersion units

**Benchmark 6a-5** Districts will implement at least one immersion unit; 2 districts will implement 2 sequenced sets of units

**Benchmark 6a-6** Districts will implement 2 immersion units with 40% of students participating

**Benchmark 6a-7** Districts will integrate immersion units into math/science curricula at all grade levels for 70% of students; create library for immersion resources and templates

**Coordinate Professional Learning, Monitoring, and Accountability of Immersion Unit Resources with Other SCALE Goals**

**Benchmark 7a-1** By the end of Fall 2004, the IDT will have specified how plans for implementing immersion units are integrated with the teaching, professional learning, monitoring, and accountability systems in the overall framework.

**Exhibit 2: Goal Three Activity: Benchmark Matrix (June 2004 – June 2005)**

<b>Benchmark:</b> (See details following matrix)	<b>Level of Attainment:</b> (Check one; enter date where appropriate)					<b>Brief Explanation for Revisions, New Benchmarks, and Target Dates:</b>
	<b>Benchmark Met</b>	<b>Benchmark Not Met</b>	<b>Target Year Revised</b>	<b>Benchmark Revised</b>	<b>No Longer a Project Benchmark</b>	
<b>2e-2</b>					X	See new Goal 3 pre-service and induction benchmark 3-3.
<b>2e-3</b>					X	See new Goal 3 pre-service and induction benchmark 3-3.
<b>2e-4</b>					X	See new Goal 3 pre-service and induction benchmark 3-3.
<b>7a-1</b>	X					
<b>7a-2</b>	X					CSUDH Summer Institute 2004 incorporated IFL Principles.
<b>7a-3</b>					X	IFL Principles will be disseminated to SCALE districts via Goal 1.
<b>7a-4</b>					X	IFL Principles will be disseminated to SCALE districts via Goal 1.
<b>8a-1</b>	X					This benchmark was met in SY 2003-2004.
<b>8a-2</b>	X			X		See new Goal 3 benchmark 3.
<b>8a-3</b>					X	Benchmarks 8a 3-6 regarding recruitment courses in biology, math, physics and chemistry at University of Pittsburgh will be discontinued. While the courses will continue to run at the University of Pittsburgh, SCALE will develop teacher recruitment models for STEM courses at local SCALE IHEs. See new Goal 3 benchmark 3-3.
<b>8a-4</b>					X	
<b>8a-5</b>					X	
<b>8a-6</b>					X	
<b>8b-1</b>					X	
<b>8b-2</b>				X		Benchmark 8b-1 has been discontinued.  Benchmark 8b-2 has been revised. The IHE conferences will be held annual and address all Goal 3 issues (see 9b-2).
<b>9a-1</b>	X					
<b>9a-2</b>	X					According to July '04 report to Joan Prival, the math course component is to be met via consideration of a related NSF, Univ. of Pittsburgh-based project called ESP (lead by Peg Smith of the LRDC) that will develop new courses to facilitate the transition from a mathematics undergraduate degree to K–12 teaching. Evaluation data will be coordinated.
<b>9a-3</b>		X				Evaluation data is used to inform testing and revisions.
<b>9a-4</b>					X	
<b>9b-2</b>	X 12/03 & 3/05			X		IHE conferences will still be held every year, and will still address issues across Goal 3.
<b>New Track 3-1</b>	X		X			Modular math courses at UW with MMSD teachers will continue into SY 2005-06.
<b>New Track 3-2</b>		X				Engagement of UW Physics faculty is on-going.
<b>New Track 3-3</b>		X				QED Title II TQE Grant was awarded. Work on benchmark began in January 2005 and is progressing.
<b>New Track 3-4</b>		X				Work towards this benchmark will progress in association with SCALE Goals 2 and 3 and the QED grant mentioned above.

## **Exhibit 2: Goal Three Activity: Benchmark Matrix (June 2004 – June 2005)**

### **Goal Three Benchmarks**

#### **Track 1: Pre-service courses**

**Benchmark 2e-2.** Pre-service and induction programs based on SCALE professional learning programs will be introduced in at least one district during the 2003-4 school year.

**Benchmark 2e-3.** Pre-service and induction programs based on SCALE professional learning programs will be introduced in two further districts during the 2004-5 school year.

**Benchmark 2e-4.** Pre-service and induction programs based on SCALE professional learning programs will be implemented in all SCALE districts during the 2005-6 school year.

**Benchmark 7a-1.** During 2003 the IFL is piloting with the School of Education at the University of Pittsburgh two pre-service courses that embed the Principles of Learning. One course is a general psychology course for all elementary education majors; the other a content specific course in the secondary education program. These courses will lay the groundwork for our SCALE programs so that new teachers are especially receptive to our programs.

**Benchmark 7a-2.** The pilots will be documented and studied in order to produce by summer 2004 course outlines and teacher guides for California State University at Dominguez Hills, which certifies teachers for LAUSD.

**Benchmark 7a-3.** Once the LAUSD pilot has been tested, we will be able by summer 2005 to offer course guides and syllabi to local IHEs servicing the other 3 SCALE districts. We expect that at least one local IHE in each of the four districts will be using these courses by 2006.

**Benchmark 7a-4.** By December 2007 we will have developed arrangements with textbook publishers to sell and market our course materials to ensure sustainability of the materials beyond the grant period. (Note: Our current experience is that universities in non-SCALE areas are also interested in the materials, especially since the Principles of Learning and Disciplinary Literacy are the foundation of SCALE work but not so uniquely tied to SCALE programs. Thus, the textbook route is quite feasible.)

#### **Track 2: STEM teacher recruitment courses**

**Benchmark 8a-1.** Courses in biology and physics will be fully developed by the end of the summer 2003, and will be tested in the Spring semester of 2004, taught by their developers. Advising offices in the science and engineering colleges and department will be asked to advertise these courses.

**Benchmark 8a-2.** By December 2003 we will have identified faculty to develop similar courses in mathematics and chemistry in the summer of 2004.

**Benchmark 8a-3.** By the summer of 2005, we will have courses developed and tested in mathematics, physics, chemistry, and biology, including a detailed syllabus, set of readings, a grading rubric, and a teacher's manual.

**Benchmark 8a-4.** By December 2005 we will have tested at least two of the courses in the local IHEs of SCALE districts.

**Benchmark 8a-5.** By December 2006 we will have tested all four of the courses in several of the local IHEs in our partner districts.

**Benchmark 8a-6.** By December 2007 we will have institutionalized all four courses in the local IHEs.

**Benchmark 8b-1.** By December 2007 we will have developed arrangements with textbook publishers to sell and market our course materials to ensure sustainability of the materials beyond the grant period. By that point, all materials will have been revised based on feedback from users at the other universities and from our own further research and evaluations at the University of Pittsburgh.

**Exhibit 2: Goal Three Activity: Benchmark Matrix (June 2004 – June 2005)**

**Benchmark 8b-2.** Starting in the fall of 2004, we will hold annual fall conferences of the IHEs involved in SCALE, together with appropriate district representatives that will support work in both track 1 and track 2. The conference participants will create and revise plans, review results of the previous years work, develop plans for expansion across local IHEs, and confer with colleagues in the other SCALE districts about how best to implement both the track 1 and track 2 courses. Annual reports resulting from these conferences will be submitted to the NSF.

**Benchmark 9a-1.** Courses in biology and physics will be fully developed by the end of the summer 2003, and will be tested in the Spring 2004, taught by their developers. Advising offices in the science and engineering colleges and departments will be asked to advertise these courses.

**Benchmark 9a-2.** By December 2003, we will have identified faculty to develop similar courses in math and chemistry in the summer of 2004.

**Benchmark 9a-3.** Develop and test courses in mathematics, physics, chemistry, and biology by the end of Year 3.

**Benchmark 9a-4.** Test at least 2 courses in local IHEs by the end of Year 3.

**Benchmark 9b-2.** Hold annual fall conferences during Years 2–5 for IHEs and district representatives to support Track 1 and Track 2 goals.

**Track 3: Collaborations to enhance pre-service courses in STEM departments.**

**Benchmark Goal 3 Track 3–1.** With the help of MMSD's MSP Title II B award from the Wisconsin Department of Public Instruction, deliver four 1-credit core math concept courses to as many as 100 MMSD teachers during 2004–2005 and provide associated support through such tools as SCALEnet.

**New Benchmark Goal 3 Track 3–2.** Engage the UW–Madison Physics Department in one or more of the mid-range or long-range strategies (i.e., develop expertise in physics learning issues, organize UW research opportunities for high school students and K-12 science teachers, create center for learning and teaching on nano-scale science, develop immersion units for advanced physics, co-facilitate pre-service teacher courses).

**New Benchmark Goal 3 Track 3–3.** If the CSUDH-led Department of Education Title II proposal "Quality Educator Development" is successful, then work with this extension of the SCALE partnership (to two community colleges) will begin to help design, implement and evaluate the new undergraduate courses in math and science, and the new features of the post-baccalaureate New Teach Induction and Masters Program laid out in the proposal.

**New Benchmark Goal 3 Track 3–4.** Produce the design for modular short courses in more STEM disciplines, based on the benchmark 3-3-1 above.

**Exhibit 2: Goal Four Activity: Benchmark Matrix (June 2004 – June 2005)**

<b>Benchmark:</b> (See details following matrix)	<b>Level of Attainment:</b> (Check one; enter date where appropriate)					<b>Brief Explanation for Revisions, New Benchmarks, and Target Dates:</b>
	<i>Benchmark Met</i>	<i>Benchmark Not Met</i>	<i>Target Year Revised</i>	<i>Benchmark Revised</i>	<i>No Longer a Project Benchmark</i>	
<b>9a</b>					X	An additional benchmark was added to a prior Goal. As a result, this benchmark is reflected in 10a.
<b>9a-1</b>					X	An additional benchmark was added to a prior Goal. As a result, this benchmark is reflected in 10a-1.
<b>9a-2</b>					X	An additional benchmark was added to a prior Goal. As a result, this benchmark is reflected in 10a-2.
<b>9a-3</b>					X	An additional benchmark was added to a prior Goal. As a result, this benchmark is reflected in 10a-3.
<b>9a-4</b>					X	An additional benchmark was added to a prior Goal. As a result, this benchmark is reflected in 10a-4.
<b>9a-5</b>					X	An additional benchmark was added to a prior Goal. As a result, this benchmark is reflected in 10a-5.
<b>9a-6</b>					X	An additional benchmark was added to a prior Goal. As a result, this benchmark is reflected in 10a-6.
<b>9a-7</b>					X	An additional benchmark was added to a prior Goal. As a result, this benchmark is reflected in 10a-7.
<b>10a</b>				X		In the fall of 2004, a literature review around issues of equity in K-12 math and science was conducted. This review is being used as the basis to begin conversations with districts around the systemic development of equity goals, strategies, and measures.
<b>10a-1</b>					X	In building a systemic plan for equity across all four districts, it was determined that cross-age tutoring was not an optimal strategy for district-wide change.
<b>10a-2</b>					X	Equity Council of Twelve met in Fall 2003 and began to select strategies for conducting pilot studies. Cross-age tutoring was not selected as one strategy.
<b>10a-3</b>			X			By the end of the third year, at least one Goal 4 strategy will be implemented at a pilot level in all four districts. To date, three of the four districts have been extensively interviewed to determine districts' particular and critical needs with respect to equity. These needs are being converted to strategies to be implanted in the particular district by the end of Year 3.
<b>10a-4</b>			X			Initial implementation of the strategy(ies) will be in place in three of four districts by end of Year 3.
<b>10a-5</b>					X	Given the approach taken for Goal 4, this benchmark is no longer necessary.
<b>10a-6</b>		X				This benchmark is a focus for Year 4.
<b>10a-7</b>		X				This benchmark is a focus for Year 5.
<b>10b</b>				X		By the end of Year 3, districts that do not currently have a system of equity benchmarks in place will have developed a system alongside the Goal 4 team.

**Exhibit 2: Goal Four Activity: Benchmark Matrix (June 2004 – June 2005)**

<b>Benchmark:</b> (See details following matrix)	<b>Level of Attainment:</b> (Check one; enter date where appropriate)					<b>Brief Explanation for Revisions, New Benchmarks, and Target Dates:</b>
	<i>Benchmark Met</i>	<i>Benchmark Not Met</i>	<i>Target Year Revised</i>	<i>Benchmark Revised</i>	<i>No Longer a Project Benchmark</i>	
<b>10b-1</b>	X					See Benchmark 10c-3.
<b>10b-2</b>	X partial					See Benchmarks 10c-1, 2, and 3.
<b>10c-1</b>						<u>New Benchmark</u> : By the end of the third year, Goal 4 team will have built a systems-based model for equity that is applicable across districts. This will serve as the basis for determining district progress and facilitating talk among districts.
<b>10c-2</b>						<u>New Benchmark</u> : By the end of the third year, Goal 4 team will have worked with each district to understand their specific needs with respect to equity. This will likely include identification of equity issues, goals, strategies and an understanding of each district's system.
<b>10c-3</b>						<u>New Benchmark</u> : By the end of the third year, Goal 4 team and districts will have identified barriers within each district that hinder the development of equity-based reforms, particularly as they relate to other SCALE goals.
<b>10c-4</b>						<u>New Benchmark</u> : In Years 3 and 4, develop and implement plans to address these barriers in each district.
<b>10c-5</b>						<u>New Benchmark</u> : In Year 4, conduct an equity think tank with all four SCALE districts and all Goal 4 personnel to share district differences and commonalities that emerge as a result of district-specific work.
<b>10d-1</b>						<u>New Benchmark</u> : In Fall 2005 (end of Year 3) hire 2 additional full-time staff to meet the growing needs of Goal 4 work.
<b>10d-2</b>						<u>New Benchmark</u> : By end of Year 3, create an Equity Advisory Board comprised of experts in the field of equity in K-12 education. Goal 4 staff will meet quarterly with advisory board for feedback on Goal 4 activities.

**Goal Four Benchmarks**

**Benchmark 9a.** Up to 6 promising Goal 4 strategies will be identified during summer 2003 by reviewing the literature, consulting our national advisory board members by email, and through interviews with successful minority and female STEM undergraduates. We will conduct a literature survey and write a summary report on the expected utility of each of the identified strategies by early Fall of 2003.

**Benchmark 9a-1.** Data from several existing cross-age tutoring programs across the US will be harvested and analyzed by the end of the first year of the grant.

**Benchmark 9a-2.** The Equity Council of Twelve will meet in the early Fall of 2003 to examine the evidence and will select two or three strategies to conduct pilot studies upon. We anticipate that cross-age tutoring will be selected as one strategy that at least one of the partner districts (LAUSD) will implement.

**Benchmark 9a-3.** By the end of the second year, at least one selected Goal 4 strategy will be implemented at a pilot level in all four districts.

**Benchmark 9a-4.** Research on the early effectiveness of these pilot implementation efforts will be completed by the summer of 2005.

**Benchmark 9a-5.** Based on the success of the pilot efforts, each district will have selected by the end of Year 3 strategies to scale-up in their districts. By the end of the fourth year, the selected strategies will be implemented in the lowest achieving schools in all four districts.

**Exhibit 2: Goal Four Activity: Benchmark Matrix (June 2004 – June 2005)**

**Benchmark 9a-6.** Research on the impact of these strategies will be conducted and summarized by the end of the fourth year.

**Benchmark 9a-7.** By the end of the fifth year, the selected strategies will be in some stage of implementation in 50% of each district's schools.

**Benchmark 10a.** Up to 6 promising Goal 4 strategies will be identified during summer 2003 by reviewing the literature, consulting our national advisory board members by email, and through interviews with successful minority and female STEM undergraduates. We will conduct a literature survey and write a summary report on the expected utility of each of the identified strategies by early Fall of 2003.

**Benchmark 10a-1.** Data from several existing cross-age tutoring programs across the US will be harvested and analyzed by the end of the first year of the grant.

**Benchmark 10a-2.** The Equity Council of Twelve will meet in the early Fall of 2003 to examine the evidence and will select two or three strategies to conduct pilot studies upon. We anticipate that cross-age tutoring will be selected as one strategy that at least one of the partner districts (LAUSD) will implement.

**Benchmark 10a-3.** By the end of the second year, at least one selected Goal 4 strategy will be implemented at a pilot level in all four districts.

**Benchmark 10a-4.** Research on the early effectiveness of these pilot implementation efforts will be completed by the summer of 2005.

**Benchmark 10a-5.** Based on the success of the pilot efforts, each district will have selected by the end of Year 3 strategies to scale-up in their districts. By the end of the fourth year, the selected strategies will be implemented in the lowest achieving schools in all four districts.

**Benchmark 10a-6.** Research on the impact of these strategies will be conducted and summarized by the end of the fourth year.

**Benchmark 10a-7.** By the end of the fifth year, the selected strategies will be in some stage of implementation in 50% of each district's schools.

**Benchmark 10b-1.** By end of Year 3, we will develop district-specific and SCALE coordinated metrics for benchmarks to monitor progress in closing equity gaps. Specifically, metrics will be implemented in districts to acquire baseline values. In addition, we will supplement the SCALE indicator system with benchmark metrics as well as develop a monitoring protocol.

**Benchmark 10b-2.** During the third year, determine across districts areas for improvement with respect to equity as well as identify successful strategies that have been implemented by the districts (to include non-SCALE-related strategies) for minimizing disparity among targeted student populations