SRI Education

BaySci

A Partnership for Bay Area Science Education

August 2014 Evaluation Report

August 2014

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SRI Education

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BaySci

A Partnership for Bay Area Science Education (BaySci) is designed to strengthen inquiry-based K-12 science instruction in the Bay Area through a concerted partnership and supportive network of local Science-Rich Educational Institutions (SREIs), school districts and district leadership, and teachers.

BaySci is led by the Lawrence Hall of Science in partnership with the Exploratorium and Inverness Research. BaySci is funded through the generous support of the S.D. Bechtel Jr. Foundation and the Gordon and Betty Moore Foundation.

For more information about BaySci, visit http://www.baysci.org/

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Introduction and Evaluation Overview

For the Bay Area Partnership for Science Education (BaySci), SRI International (SRI) has served as external summative evaluator, studying two academic years (AYs) of BaySci programming for academic years 2012/13 (year 1) and 2013/14 (year 2). As evaluators, we have examined the degree to which BaySci programming strategically supports its intended mission and produces key outcomes for participating districts, teachers, and Science-Rich Educational Institutions (SREIs). We have explored BaySci's success in establishing networked communities of practice that systematically enhance science teaching in the Bay Area and that can be sustained beyond the life of the project. We have coordinated this work with that of the developmental evaluator, Inverness Research.

We have examined how and to what degree science instruction has changed in the classrooms of districts, schools, and individuals participating in BaySci programming. We have sought evidence of changes in classroom practice, student learning and engagement, and district and school culture. Specifically, the evaluation has documented evidence aligned with four intended outcomes in the BaySci program logic model (see Figure 1).

The evaluation goals follow with brief overviews of the findings for each:

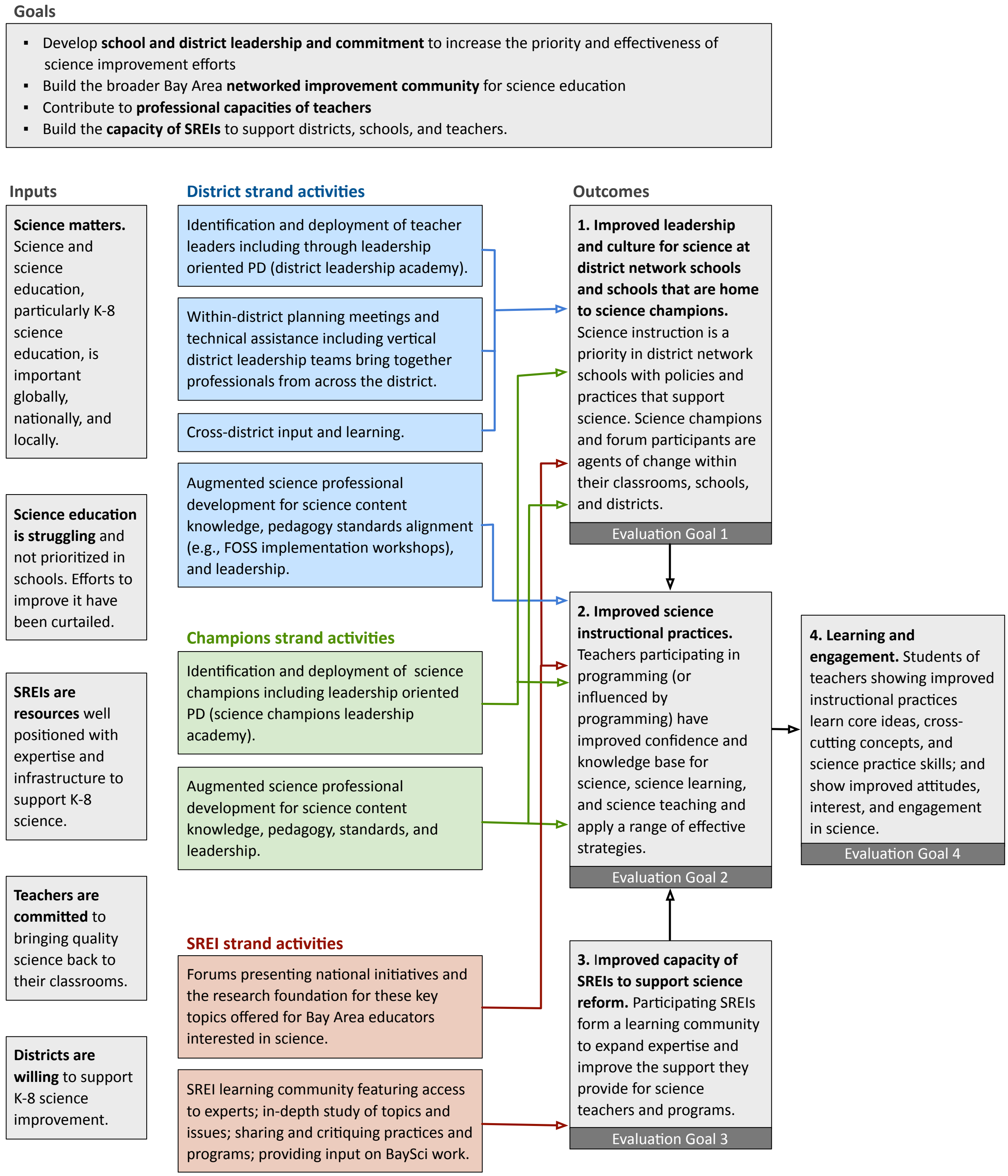
- **Evaluation Goal 1**. *Describe changes in leadership and culture in districts participating in the District Strand or that have Science Champions Strand participants among their school staff. (*Aligns with *Outcome 1: Improved leadership and culture*.)
  Our findings in this area are that participants rated their districts favorable on several indicators of science leadership and culture. Many of the features of science leadership most appreciated by participants, such as the use of dedicated staff for science and strong support for science through materials management, were among those targeted through BaySci's district level interventions.
- **Evaluation Goal 2.** *Describe changes in elementary science instructional practices in districts participating in the BaySci District Strand and Science Champions Strand. (*Aligns with *Outcome 2: Improved elementary science instructional practices).*
  Participating BaySci teachers and science specialists reported offering more science overall since starting to work with BaySci. These gains came primarily through more extended lesson length rather than through more frequent lessons. The largest

increases in the amount of science offered between the start of BaySci and the fall of 2013 were in the districts that have participated in BaySci the longest. Teachers and science specialists reported offering more inquiry-oriented science and increasingly integrating English language arts (ELA) with their science instruction since joining BaySci

- **Evaluation Goal 3.** Analyze changes in the professional capacity and network of participants in the BaySci SREI Learning Community.
  Aligns with *Outcome 3: Improved capacity of SREIs to support science reform*.
  The SREI learning community provided unprecedented opportunities for staff who work to support school and district improvement in science to talk about the big ideas that shape their work, learn about current research related to their work, and build professional connections with SREI professionals working on similar problems in different settings. Many participants in the SREI Learning Community came away from their experiences with new ideas for approaching the support they provide to schools and districts
- **Evaluation Goal 4.** *Document student engagement and learning outcomes for students whose instruction is influenced by BaySci professional development or district leadership. (Aligns with Outcome 4: Student learning and engagement.)*
  Teachers reported that students were more engaged in science since they started working in BaySci. Teachers also reported that integration of science with ELA had contributed to improvements in student abilities to express ideas in writing and verbally.

Each of the expected outcomes and evaluation goals from the BaySci Logic model is described more fully in Part II of this report. This report documents the diverse efforts of BaySci to improve science instruction in Bay Area schools and highlights the key findings of the evaluation.

Figure 1. Representation of the BaySci logic model, based on the 2012 BaySci proposal and discussion with BaySci program leaders.



BaySci Program Activities and Intended Outcomes

Since academic year (AY) 2008-2009, BaySci, a Partnership for Bay Area Science Education has been working to elevate the quality and quantity of science instruction in the San Francisco Bay Area.

BaySci provides pedagogical and content-oriented professional development for participating teachers and, works to bolster science leadership capacity in participating schools and districts through leadership-oriented professional development and support for teachers and administrators at the school and district levels. Participating districts commit to participating in the programming and to the science instruction improvement effort.

BaySci Programming

BaySci is led by the Lawrence Hall of Science in partnership with the Exploratorium, Inverness Research, and eight Bay Area school districts. BaySci is premised on the tenet that Bay Area SREIs are well poised to play a key role in contributing to capacity-building and strengthening science education in schools.

BaySci programming consists of three strands of activity functioning in parallel, all of which aim to develop the professional capacity and leadership of science educators and improve the quality and quantity of science instruction in the Bay Area. Each of the three partner main organizations leads a strand of BaySci programming, and each strand draws on the collaboration or support of all three partners. Here we describe the programming offered in each of the three parallel strands of BaySci.

District Strand

In AY 2012-2013 and AY 2013-2014[1] while BaySci grew and began offering new kinds of programming, existing offerings aimed at building science leadership capacity and providing professional development to teachers in participating districts continued as the District Strand of BaySci. Led by the Lawrence Hall of Science, the District Strand (also sometimes

[1] Although BaySci follows a school year calendar, much of the programming for each school year cohort begins in the summer before the school year begins. We refer to the years of programming using the abbreviation AY for academic years. Each academic year of BaySci programming includes summer programming preceding the start of school

referred to as the District Network Strand) includes support for science leadership teams in each district, a teacher leadership academy for teachers taking on increasing science leadership roles in their schools, and Full Option Science System (FOSS) workshops offered to support teachers in effective use of the FOSS curriculum. Teachers who participated in prior years of BaySci professional development had the option of joining one of two master groups with weekend workshops offered by the Lawrence Hall of Science and the Exploratorium. In 2012, the District Strand grew from four districts adding a new 5th district. Two additional districts joined BaySci in AY 2013-2014.

The nine districts that have participated in the BaySci District Strand since the start of BaySci and the dates of their participation are shown in table 1 (below). All districts except Palo Alto Unified were part of BaySci for some or all of academic years 2012/13 and 2013/14, the period of this evaluation.

Table 0-1. BaySci District Strand participating districts for academic year 2008/9 - 2013/14. Source: BaySci staff.

District	2008/9	2009/10	2010/11	2011/12	2012/13	2013/14
					Year 1 of this eval.	**Year 2 of this eval.**
Newark Unified School District 2008 - present	■	■	■	■	■	■
Novato Unified School District [1] 2008 - 2013	■	■	■	■	■	
Palo Alto Unified School District [2] 2008-2011	■	■	■			
Petaluma Unified School District 2008 - present	■	■	■	■	■	■
Alameda Unified School District 2012 - present					■	■
Oakland Unified School District 2012 - present					■	■
Orinda Unified School District 2013 - present					■	■
San Mateo Foster City School District [3] 2013-present						■
Santa Clara Unified School District 2012 - present					■	■

[1] Novato began the 2013/14 school year by sending a team to the Teacher Leadership Academy but discontinued involvement during that year.
[2] Palo Alto did not participate as a district during the two years of this evaluation.
[3] San Mateo Foster City school district began with partial involvement in 2013-14 only becoming a fully participating district in the 2014-15 school year.

The BaySci District Strand provides a range of opportunities for administrators and teachers. Its professional development efforts are aimed at improving science content knowledge, pedagogy, standards support, and leadership. BaySci also facilitates three annual planning meetings with science leadership in each participating district. FOSS implementation workshops are held for teachers at particular grade levels, as are strategic meetings with district leadership. Other programming, such as the Teacher Leadership Academy (TLA), brings together staff from across districts. Through these combined efforts BaySci offers support tailored to the needs and science readiness of each participating district while allowing leaders to learn from the experiences of educators in other districts. Table 2 (below) summarizes participation in the District Strand activities for AY 2012-2013 and AY 2013-2014. Note that participants could enroll in more than one program; thus, the last row, which counts all participants for a given year, is less than the sum of each program's participants.

Table 2. Participation in District Strand activities, AY 2012-2013 and AY 2013-2014. Source: Participant rosters.

Program and number of days offered [1]	Year 1 (2012/13) participants	Year 2 (2013/14) participants
District Leadership Seminars hosted by Lawrence Hall of Science 3 sessions per year	50	57
Teacher Leadership Academy hosted by Lawrence Hall of Science 1 week, plus 3 follow-up sessions per year	35	56
District Strand Master Group hosted by Lawrence Hall of Science [2] 4 sessions in year 1, 3 sessions in year 2	11	22
District Strand Master Group hosted by Exploratorium [2] 4 sessions in year 1, 3 sessions in year 2	12	18

[1] Not all participants attended all days of the programming.
[2] Returning BaySci participants could take part in Master Groups at either the Lawrence Hall of Science or the Exploratorium

Although anyone who has participated in BaySci before may take part in the BaySci Master groups, criteria for initial entry into the program varies by district. District science coordinators were in charge of nominating burgeoning teacher leaders for participation in the Teacher Leadership Academy. In many cases teachers told us that they were recruited because someone closely involved in BaySci (the science coordinator or another Leadership Team member) was aware that they are interested in science, that they have taken on leadership roles related to science, or that they are well-positioned to have an impact on science instruction in their school or district.

The Science Champions Strand

An addition in AY 2012-2013 was the Science Champions Strand, led by the Exploratorium. The Science Champions Strand provides professional development for teachers who are committed to improving science instruction and taking on leadership roles, but whose districts do not participate in the district strand. Science Champions aim to influence science instruction in their schools by serving as exemplary teachers and by strategically taking on local leadership opportunities that advance science.

The Science Champions Stand offers a summer academy with school year follow-up sessions for teachers who do not work in participating districts. The Science Champions Academy, by necessity, differs from the Teacher Leadership Academy in that participating teachers are not working in a community supported by the BaySci district strand activities. Teachers who participated in the first year of the Science Champions Strand were invited to participate in three Saturday follow-up sessions the following year.

To recruit participants, district leaders (Superintendents, Assistant Superintendents, Directors of Curriculum and Instruction, Principals, etc.) throughout the nine Bay Area Counties were emailed a workshop brochure with the request to share it with teachers and science resource teachers who would be good candidates for the Champions Academy. In the second year, teachers in the original cohort were also sent brochures to share with their professional contacts. Interested teachers submitted applications providing information about themselves related to science teaching and leadership experience, professional development experience, and their goals for growth in science teaching; they also were asked to indicate their ideas about strong science teaching and the main challenges in their schools or districts. The application required a principal's or district supervisor's signature, indicating supports on the school- level for each Science Champions Strand participant.

The Science Champions Strand Organizers at the Exploratorium sought to recruit participants who were likely to become local leaders and champions for science education in their schools or districts. Participants were ranked on the basis of how well their applications met the following criteria:

- Commitment to science instruction in their classrooms and districts
- Regular teaching of science
- Willingness to explore strategies to expand and enhance their current approaches to the science curriculum
- Interest in sharing ideas with their colleagues.

In choosing the initial Science Champions Strand cohort from among the teacher applicants, the Exploratorium also considered each cohort's overall balance of grade levels, use of instructional materials (FOSS, other hands-on materials, textbooks), and geographical location (by country, district, school).

The second cohort of the BaySci Science Champions Strand (AY 2013/14) had more applicants, and the Exploratorium faced several issues in selecting participants. One was reaching a balance between developing a critical mass of Science Champions in a given school or district to deepen local impact versus broadening the effort to include participants from counties, districts, and schools not yet represented. The Exploratorium decided to select Champions in pairs coming from the same site so that participants would not be working alone as science champions in their schools. The Exploratorium decided to select half of the second cohort from returning districts or schools and half from new districts and counties. The

Exploratorium was also interested in predicting who would benefit most in terms of innovating their classrooms and who was positioned to make an impact on their schools and district. To increase impact, a large number of science resource teachers (SRTs)—in many cases, the sole providers of science instruction for a large number of students—were chosen. Table 3 (below) summarizes participation in the Science Champions Strand activities for AY 2012-2013 and AY 2013-2014.

Table 3. Participation in Science Champions Strand activities, AY 2012-2013 and AY 2013-2014. Source: Participant Rosters.

Program and number of days offered [1]	Year 1 (2012/13) participants	Year 2 (2013/14) participants
Science Champions Academy hosted by Exploratorium 1 week plus follow up sessions – 4 in year 1, 3 in year 2	37	40
Champions Strand Master Group hosted by Exploratorium 3 sessions in year 2	N/A [2]	25

[1] Not all participants attended all days of the programming.
[2] Because 2012/13 was the first year for the Champions strand, there were no returning champions to participate in Master group seminars in year 1.

The SREI Strand

The third strand of BaySci programming, new in AY 2012-2013, is the SREI Strand led by Inverness Research. The SREI Strand includes the SREI Learning Community, which consists of professionals from science museums and other SREI institutions. It aims to improve science instruction by developing a professional community that comprises the SREI professionals who support science teachers and districts. The following organizations participate in the SREI Strand:

- California Academy of Sciences
- Chabot Space and Science Center
- Exploratorium
- Lawrence Berkeley National Laboratory
- Lawrence Hall of Science
- The Monterey Bay Aquarium
- The University of California San Francisco Science and Health Education Partnership
- Santa Barbara Museum of Natural History.

In its first years, the SREI Learning Community afforded opportunities for SREI professionals who support schools and districts to meet, discuss shared problems, and engage in organized professional development activities, including addresses by expert speakers and selected reading materials. Learning Community Members met to identify shared interests and needs and plan SREI activities; participated in workshops on NGSS; and convened in study groups on science discourse (year 1), and on oral language in science, learning research, and engineering practices (year 2).

In July 2012, a design team of 10 individuals from 6 organizations plus 4 staff from Inverness Research met to discuss professional development needs that span the institutions and choose topics they wanted to explore further.

In November 2013, to follow up on the work from the initial design team meeting, an expanded design team met to work on more detailed planning and implementation. The team determined that two interests—NGSS and a study group on learning research—were shared across organizations. Selected participants also agreed to be responsible for planning, designing, and hosting future meetings.

In April 2013, representatives from eight SREIs and the two BaySci evaluation groups attended the NGSS Workshop, Part I "Primer" hosted by the California Academy of Sciences. Craig Strang of Lawrence Hall of Science led the activities. Meetings of the Learning Research Study Group were held in May, June, and July 2013. Participants read scholarly works on discourse in science classrooms, and met to discuss the readings and correlate the readings with the NGSS transition.

The SREI strand also sponsored the BaySci Forum, an event held on September 30, 2013, and open to educators throughout the Bay Area. The BaySci Forum included a panel of national science education leaders who discussed science discourse, its role in NGSS and Common Core State Standards for English Language Arts, and ideas on implementation. The SREI strand also facilitated building and support for relationships between professionals in different SREI institutions. Table 4 (below) summarizes participation in the SREI strand activities for AY 2012-2013 and AY 2013-2014.

Table 4. Participation in the SREI Learning Community, AY 2012-2013 and AY 2013-2014. Source: Inverness Research staff.

Program	Year 1 (2012-13) participants	Year 2 (2013-14) participants
SREI Learning Community Planning Meeting Single session	9	N/A
Study Groups on Science Talk and Workshops on Oral Language in Science Series of 3 meetings each year	30 (study groups)	33 (workshops)
Study groups on learning research Series of 3 meetings	29	N/A
NGSS Workshops Full-day workshop in year 1, 1.5-day workshop in year 2	35	42

The three strand of BaySci programming above contribute to the outcomes outlined in the BaySci logic model.

BaySci Intended Outcomes

Each strand of BaySci programming aims to directly influence two of the three BaySci outcomes, and all three strands of activity aim to support improvements in science learning for students (see Figure 1 above).

In 2011, in their capacity as external evaluator for BaySci, Inverness Research released a report evaluating the first three years of BaySci programming. The Inverness Research report examined the degree to which participating districts were improving their priority level for science, district level capacity to support science, instructional capacity, and opportunities to learn science. It also addressed districts' methods for doing so. They found that the four districts participating in BaySci at the time had assigned elevated priority to science as demonstrated by increased district professional development time dedicated to science, investment in staffing such as science coordinators who support science instruction, budget allotments for science curricular materials and supplies, and clear communication from district leadership about expectations that science should be taught regularly. The report also found that BaySci had contributed to district capacity by providing customized support to foster the development of district plans and vision for science, leadership development, and the creation of materials management systems. The 2011 evaluation report also credited BaySci with two main areas of instructional capacity-building: building teaching capacity through professional development programming for teacher-leaders, and improving overall teacher confidence and preparedness by making high-quality curriculum materials available. All of the changes outlined above supported improved quality and quantity of science instruction.

In the sections that follow, we describe expected outcomes from the revised BaySci logic model through enhanced: school and district leadership and culture; science instruction and teacher capacity; SREI organization capacity; and student learning and engagement.

Outcome 1. Improved leadership and culture

Two strands of BaySci activity, the District Strand and the Science Champions Strand, aim to contribute to improved leadership and culture for elementary science in the Bay Area. In the District Strand, BaySci identifies teacher and administrator leaders for leadership-oriented professional development. The Science Champions Strand, in which teachers participate in professional development without district-level involvement, emphasizes individual leadership opportunities.

In the District Strand, SRI looked for evidence of improved leadership and a culture promoting elementary science education using the BaySci District Capacity Framework. That framework provides guiding questions regarding a school district's capacities and policies that are necessary to develop and sustain a standards-based elementary science education program. SRI focused on the degree to which districts and schools are working toward change in six main areas:

1.1 Policies aligned to support science education

1.2 Quality materials and materials management

1.3 Multilevel, distributed leadership focused on science

1.4 Processes for identifying and quickly addressing critical gaps in their ability to sustain and improve elementary science

1.5 Strategic priorities for using external/community resources

1.6 Professional development that helps teachers learn content and pedagogy, with on-the-job support for implementation and reflection.

In the Champions Strand, participants were introduced to the leadership possibilities in their roles as classroom teachers or science specialist teachers. SRI searched for evidence of growth in the champions' leadership capacities, their contributions to school science culture, and the extent and means by which they act as agents of change in their classrooms, schools, and districts. Among Champions, SRI looked for the following areas of evidence:

1.7 Champions' development of knowledge, skills, and confidence

1.8 If and how champions improve and share their own practices

1.9 If and how champions assume leadership roles and are empowered to initiate and undertake improvement efforts in local settings.

Outcome 2. Improved elementary science instructional practices

The professional development activities offered in both the District Strand and Science Champions Strand aim to directly improve the quality of science instruction in the classrooms of participating teachers. SRI sought evidence of improved confidence and knowledge base for science, science learning, and science teaching, and looked for evidence of whether teachers applied a range of effective strategies. We were also interested in evidence of change in both the quantity and quality of science instruction:

2.1 Teachers offer more science programming (hours per week).

2.2 Individual teachers expand their range of instructional practices.

2.3 Teachers provide students with opportunities to learn science by engaging in the science and engineering practices of the NRC Framework and the Next Generation Science Standards.[2]

Outcome 3. Improved capacity of SREIs to support science reform

One strand of BaySci programming, the BaySci SREI Learning Community, was designed to build professional capacity in strategic areas and to develop and strengthen the professional community of SREI educators who work with teachers and schools. SREI professionals met several times over the past 2 years in different formats, met professional colleagues at different institutions, and identified common goals and interests.

SREIs form a Learning Community that supports organizations in expanding internal expertise and improving the sophistication of the support they provide to districts, schools, and/or teacher capacity building. The Learning Community is characterized by:

3.1 Collaboration with other institutions, including other BaySci strands to meet SREI learning community goals

3.2 Improvement of SREI professional development program designs and the design thinking of professional development staff.

Outcome 4. Student learning and engagement

The BaySci strategy assumes that students exposed to improved science instructional practices learn core ideas, crosscutting concepts, and science practices skills, and demonstrate improved attitudes, interest, and engagement in science. SRI sought evidence for the following:

4.1 Students exposed to improved science instructional practices show evidence of development of science and engineering practices.

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[2] Science and engineering practices refers to the practices outlined in National Research Council. (2011). *A Framework for K-12 Science Education: Practices, crosscutting concepts, and core ideas.* Washington, DC: National Academies Press. These practices also make up dimension I of the Next Generation Science Standards and are as follows: (1) Asking questions and/or defining problems, (2) Developing and using models; (3) Planning and carrying out investigations; (4) Analyzing and interpreting data; (5) Using mathematics and computational thinking; (6) Constructing explanations and/or designing solutions; (7) Engaging in argument from evidence; (8) Obtaining, evaluating, and communicating information.

4.2 Students show improved attitudes, interest, and engagement in science.

The four expected outcomes of the BaySci program form the questions that guide this evaluation. In each of the areas described above, evaluators look for evidence of strength and improvement over time in individual and institutional participants in BaySci.

Evaluation Methods

SRI Evaluators developed data collection instruments and approaches to ensure that multiple data sources and methods supported each of the evaluation outcomes identified in the project logic model. Data sources included participant surveys, classroom observations, and interviews with school and district staff.

Each data collection strategy served multiple goals. For example, teacher survey questions concerning district-wide or school-wide consensus on science (Goal 1) appear alongside questions about the frequency and duration of science in their classrooms (Goal 3). Each data type and data collection strategies therefore served multiple purposes.

Existing instrument resources such as the observation protocol used by Inverness Research in prior BaySci evaluations were incorporated and adapted to serve the data collection strategy and ensure continuity with previous and concurrent BaySci evaluations. This instrument was based on an observation protocol developed by Horizon Research[3]. Additional instruments were also designed to address new aspects of the evaluation.

Some data collection was carried out with repeat measures, thereby allowing us to document change over time in connection with program participation. Systematic data collection included observations of elementary classrooms and professional development activities, as well as surveys and interviews with participants of both the BaySci District Strand and the Science Champions Strand. An overview of data collection approaches is provided below.

Table 5 (below) outlines the relationship between the main sources of evaluation data and BaySci anticipated outcomes. Anticipated outcomes are often associated with more than one data source.

[3] Weiss, I., Pasley, J., Smith, S., Banilower, E., & Heck, D. (2003). *Highlights report, looking inside the classroom: A study of K-12 mathematics and science education in the United States*. Chapel Hill, NC: Horizon Research Inc.

Table 5. Relationships between the main data sources and BaySci anticipated outcomes.

Data source	Link to expected BaySci outcomes with example details
Observations of BaySci Programming	*Outcome 1.* Improved leadership and culture *Outcome 2.* Improved elementary science instructional practices*
School and District Staff Survey	*Outcome 1.* Improved leadership and culture • District culture and capacity for supporting science (e.g., vision, leadership, curriculum, policy, priority). • Professional development needs and activities of districts and individual teachers. • Quality of science instruction • Student learning and engagement
Classroom Observations	*Outcome 2.* Improved elementary science instructional practices • Instructional practices of BaySci participating teachers. • Quality of science offered by BaySci participating teachers. *Outcome 4.* Student learning and engagement • Student engagement with activities and STEM content. • Student engagement with Science and Engineering Practices.
Interviews with school and district staff	*Outcome 1.* Improved leadership and culture • District culture and capacity for supporting science (vision, leadership, curriculum, policy, priority). *Outcome 2.* Improved elementary science instructional practices • Instructional practices of teachers participating in BaySci. • Changes to instruction since starting BaySci.
Interviews with SREI strand participants	*Outcome 3.* Improved capacity of SREIs to support science reform • Characterization of: the support that SREIs provide to schools and districts, and the professional development needs of SREI professionals. • Experiences of SREI professions in SREI strand activities. • Collaborations resulting from SREI strand activities.

* Observing classrooms of BaySci participating teachers indirectly supports BaySci evaluation goals by allowing BaySci evaluators to make connections between the classroom practices observed and teachers' leadership and culture characteristics.

Data Collection

Each data source description below includes information concerning the evaluation goals for which the source was expected to provide information, along with an overview of the data collection efforts associated with that data source.

Data sources used in the evaluation include observations of BaySci programming, surveys of school and district staff, classroom observations, interviews with school and district staff, and interviews with SREI strand participants. Each of the data sources is described in this section. Table 6 provides an overview of the amount of data collected for this study. Because SRI was able to pool data for classroom observations and school and district staff interviews with BaySci developmental evaluator Inverness Research, we have included the total counts of data used in this evaluation in the table, while noting which were collected by Inverness Research in parentheses.

Table 6. Data collection totals for the evaluation. Totals represented in each cells. The subset of data collected by Inverness Research (IR) is indicated in parentheses.

Data Source	Year 1 (2012-2013)	Year 2 (2013-2014)	Both Years
School and District Staff Survey	-	179	179
Classroom Observations	26 (8 IR)	39 (11 IR)*	65 (19 IR)
Interviews with school and district staff	29 (7 IR)	39 (11 IR)*	68 (18 IR)
Interviews with SREI strand participants	11	N/A	11

* The sample of teachers observed and interviewed by SRI in year 2 includes 10 teachers who were also observed and interviewed during year 1.

Observations of BaySci Programming

BaySci professional development institutes for teacher leaders and district staff are offered in intensive weeklong formats during the summer breaks with follow-up sessions during the school year. During both program years, SRI observed professional development workshops for teacher leaders and district staff during the summer and school year (19 visits in all). Observations of professional development were divided between the District Strand and Champions Strand programming. SRI also observed three SREI Strand events, including the September 2014 BaySci forum held at the Exploratorium. SRI carried out open-ended programming observations without the use of an observation protocol.

School and District Staff Survey

SRI administered surveys to BaySci participants in fall 2013 and repeated a subset of the survey items in spring 2014. Survey participants included teachers and administrators who had participated in BaySci programming at any time during the previous 2 years. The first survey, administered during October and November of 2013, was sent to 227 BaySci participants. We collected 179 complete responses (for a response rate of 79%) from 116 BaySci District Strand participants and 64 Science Champions Strand participants. The surveys used branching, with different versions of similar questions going to Science Champions Strand participants and District Strand participants. Questions sometimes differed on the basis of the respondent's job title (teacher, administrator, etc.) or teaching experience.

An overview of the responses is provided in Table 7 (below). Note that total number of respondents to any given item varies from what is shown here because not all respondents answered every question.

Table 7. Survey respondent counts by role and district. Source: Fall survey.

Respondent Type	Number
Respondent counts by role	
Classroom teachers (note that many indicated more than 1 grade)	126
Kindergarten	28
Grade 1	34
Grade 2	36
Grade 3	42
Grade 4	54
Grade 5	48
Grade 6	7
Other than grades K-6 (classroom teacher)	5
Science specialists	22
School administrators	11
District administrators*	15
Other	5
Respondent counts by district	
Alameda Unified School District	17
Newark Unified School District	18
Novato Unified School District	12
Oakland Unified School District	19
Orinda Unified School District	10
Petaluma Unified School District	19
Santa Clara Unified School District	15
Palo Alto Unified School District	4
Other (most Champions are in this group*)	75
TOTAL	**179**

We followed up with survey respondents in spring 2014 to repeat a subset of questions related to the amount of science being taught. Spring surveys were administered only to the 148 fall survey respondents who were classroom teachers or science specialist teachers. We collected 92 responses (for a response rate of 62%).

With the goal of collecting responses from participants who were representative of BaySci participants as a whole, we employed several strategies to encourage survey response. Survey participants were offered a $25 Amazon.com gift card for participating. First, staff members from the Lawrence Hall of Science and Exploratorium emailed participants asking them to look for a survey from SRI. Following that initial outreach, we sent emails to BaySci participants every 2 weeks reminding them to complete the survey. During this time, SRI also attended BaySci programming and reminded teachers about the importance of the survey.

* Two Champions from Orinda participated in year 1, before their district joined the district strand. They are counted in the number of respondents from the Orinda district.

Many survey questions pertained to leadership, culture, and support around science in the respondents' school and district. These items were developed using the BaySci District Capacity Framework as a guide. Other questions emphasized instructional practices and student learning and engagement in their classrooms during science. The survey items are included in Appendix A, along with summaries of responses to each item. The survey was first pilot-tested with master group teachers from AY 2012-2013. Feedback from the pilot surveys informed revisions of survey items. Pilot teachers were included in the final survey.

Interviews with school and district staff

SRI conducted face-to-face interviews with classroom teachers and science specialists following our classroom observations. in many cases these conversations allowed SRI to inquire further about the lesson observed and situate it better within the teacher's larger unit of study. We also conducted phone interviews of district administrators who participated in district leadership teams.

Participants were sampled for interviews from each BaySci strand and BaySci programming type. Because both SRI and Inverness Research carried out interviews, we used the same sample frame to eliminate sampling overlap, and to increase the breadth and diversity of BaySci program participants represented in the sample. SRI's sample included a mix of participants representing the Science Champions Strand and District Strand in a proportion of approximately 1:2. For the Science Champions, we sampled randomly across participants each year and contacted sampled teachers with requests for classroom observations.

Sampling of District Strand participants was carried out in each district to ensure that all districts were represented in the final data. Again, for these interviews, SRI and Inverness Research shared the same sample frame. Several teachers invited to participate declined to be observed (8) or did not respond to our requests (20). Accordingly, we sought to replace them with alternates comparable in terms of role and school district. We note, that because of teachers' decisions not to participate or lack of response, the final sample did not include the ideal balance of programming types and districts.

Interviews focused on teaching practice and the leadership and culture of science instruction in schools and districts. Interviews required an average of 30-60 minutes to complete. For a few teachers, who had limited time availability, interviews were conducted in approximately 15-20 minutes. As it had with the observation data, SRI was able to pool the interview data with formative evaluators at Inverness Research.

Classroom observations

SRI carried out classroom observations of BaySci participants who work as classroom teachers. Observations were carried out using the same sample as that used for interviews, but excluding interviewees who were not classroom teachers. Classroom observations were carried out using a standard protocol adapted from the one Horizon Research protocol used by Inverness Research in previous BaySci evaluations[4]. The observation protocol included open-ended items such as descriptions of each classroom activity; closed-ended categorical coding such as selection of lesson goals from a standard list; and observer assessments, using scales, of instruction and instructional resources.

SRI added new items to capture classroom activity aligned with the Science and Engineering Practices outlined in the 2011 National Resource Council Framework for K-12 Science Education and the Next Generation Science Standards (NGSS)[5]. For each of the eight practices, we documented observed examples of teachers asking students to engage in the practice and if and how students engaged with the practice. Each classroom observation was documented using the protocol during the lesson activities, and observers carried out the more evaluative coding (e.g., rating the quality of instruction) shortly after each observation.

Interviews with SREI Learning Community participants

To learn about changes to the professional capacity of SREI educators, SRI also carried out 11 interviews with professionals working in Bay Area SREIs who participated in one or more BaySci SREI strand activity. Our interviewees included professionals with varying levels of experience in the field, a wide range of school-serving positions in their organizations, and people working in each of the participating institutions. Interview participants included one individual who attended all 5 BaySci SREI strand events during the designated period of time, 3 who attended 3 events, 6 who attended 2 events, and 1 who attended a single event.

Interviewees represented six Bay Area SREI institutions—two individuals each from 5 institutions and 1 individual from the last institution. Interviewees' experience in the field varied, ranging from those engaged in curriculum development to education department

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[4] Weiss, I., Pasley, J., Smith, S., Banilower, E., & Heck, D. (2003). *Highlights report, Looking inside the classroom: A study of K-12 mathematics and science education in the United States*. Chapel Hill, NC: Horizon Research Inc.

[5] National Research Council. (2011). A Framework for K----12 Science Education: Practices, crosscutting concepts, and core ideas. Washington, DC: National Academies Press.
NGSS Lead States. (2013). *Next Generation Science Standards: For States, By State*s. Washington, DC: The National Academies Press. http://www.nextgenscience.org/next-generation-science-standards

directors. Some interviewees were involved in the planning and organization of SREI strand activities. Exhibit 1 in Appendix C presents details about interviewees' participation in programming and their institutional roles.

For the interviews, which lasted between 25 and 45 minutes, we asked different sets of questions based on the activities in which the interviewees participated, whether they were involved in SREI strand planning, and their roles in their institutions. We were interested in learning of any benefits for the individual professional development of SREI educators who support schools and districts, as well as any impacts resulting from fostering a healthy learning community among SREI educators.

In addition, the interviews with SREI strand participants focused on better understanding how institutions provide support to schools and district as well as identifying districts' professional development needs. We also learned about experiences in the SREI programming, professional relationships formed or reinforced during programming, and ideas for the SREI professional community moving forward.

Other data sources

SRI monitored standardized test performance of districts participating in the District Strand throughout the evaluation. Several limitations in available test data affected its utility for the evaluation, including:

- Science content is not tested before fifth grade.
- Data were aggregated over entire schools rather than by individual classrooms, making it difficult to compare those data with the teacher practices we documented.

Despite these limitations, it was helpful to monitor available results from 2007 (as a baseline) through 2013 and note changes in performance for participating school districts.

Additional data sources also included a short (four-item) follow-up survey conducted in spring 2014 and informal reviews of student science notebooks or lesson planning documents as they were made available during classroom observation visits. We also listened in on planning calls in preparation for SREI strand activities and monitored select online discussions in EdModo between teachers participating in the BaySci Science Champions Strand.

Analysis

SRI initially conducted analysis of each data source separately. In the later phases of the evaluation, when all data were in hand, we synthesized across data sources to enhance interpretation and provide more robust evidence for findings.

Analysis of data from individual sources

SRI carried out several approaches in analyzing each of the main data sources throughout the evaluation. We initially summarized survey responses from the full set of BaySci participant respondents. Later we documented responses from each district participating in the District Strand and from Science Champions strand separately (as documented in Appendix A, in-district analysis summaries). For some survey items, we also identified particular groups of interest on the basis of respondent characteristics such as role, teaching experience, or years with BaySci. For example, we compared the responses of teachers and district-level staff on survey items related to leadership and culture, and we compared teachers in their first year in BaySci with those who had been with BaySci longer in regard to their confidence in their science instruction.

To identify change over time, many survey items and interview questions asked teachers to reflect back on their experience before joining BaySci. For these kinds of items, we compared responses describing current teaching practices and outcomes in relation to their self-reported experiences before BaySci. A small subset of fall survey items were also repeated in the spring to help with documentation of change over time. These items were also analyzed in comparison with items from the fall survey and reflecting on prior to BaySci.

Interview and observation data were recorded in structured protocols. In interviews, data were recoded thematically rather than chronologically; if teachers jumped ahead and answered questions not yet asked, we organized field note records according to topics. Similarly, field notes from classroom observations included separate areas for classroom resources, goals of lessons, and other topics that connected with evaluation questions. Field data recorded in this fashion was primed for analysis structured according to each evaluation question. For each topic, we used a grounded approach, seeking and categorizing recurring themes within the text of teacher comments on related topics. Initial analysis explored specific groups topics or sub-questions together; for example, by synthesizing teacher comments on if and how their teaching practices had changed since joining BaySci. In subsequent analysis, we looked for themes in the records collected in each district analyzed.

Synthesis across data sources

Once we had analyzed data from individual sources separately, we grouped and compared different individual data sources. In many cases, we could compare data collected from larger numbers of participants on closed-ended items (e.g., from the surveys) with data from open-ended items from different sources. For example, we explored teacher interview remarks about school and district leadership and culture to inform our interpretation of teacher ratings on the same topic from surveys. Cross-referencing finding across data sources allowed us to achieve more robust evidence for some findings.

Findings

SRI carried out a range of analytic activities in support of each of the evaluation goals. Below we describe findings from across the range of relevant data sources. This section is organized according to the three main expected outcomes of BaySci programming and the three evaluation goals.

Outcome 1. Changes to Leadership and Culture

We have organized findings concerning leadership and culture according to several high-level categories of the BaySci District Capacity Framework. Inverness Research developed the framework in previous work with BaySci to support documentation of district capacities needed for building a strong science education program. By breaking down those capacities, the framework allows district leaders and BaySci staff to identify growth areas and compare district capacities over time.

The high-level District Capacity Framework categories for describing district capacity include: vision and reality, leadership, instructional improvement capacities, district policies and priorities, and contextual conditions. By building on priorities set out in the framework, a district is deemed to have a strong leadership and culture for science when: the vision for science instruction is shared and well-communicated, high-capacity staff leaders are in place to support teachers in science, curriculum and materials support is provided, professional development is offered, and policies in support of science have been promulgated.

Evaluation Goal 1

Describe changes in leadership and culture in districts participating in the District Strand or that have Science Champions Strand participants among their school staff.

This includes the changing roles and leadership participation of Science Champions.

Aligns with Outcome 1: Improved leadership and culture
Science instruction is a priority in District Strand schools with policies and practices that support science. Science Champions are agents of change in their classrooms, schools, and districts.

The BaySci District Strand aims to contribute to leadership and culture for science in districts that participate in the District Strand. This strand uses a multipronged approach to build capacity across the districts and support all levels of leadership in developing and carrying out science improvement strategies.

The Science Champions Strand also aims to develop science leadership capacity among participants in the Science Champions Academy. Science Champions take on leadership roles individually in their schools and districts without the support of participating district leadership. As classroom teachers and science specialist teachers, Science Champions participants may have limited impact on district policies, but they can serve as science resources for peers and advocate for science in staff meetings, professional development sessions, and other settings.

Although the Science Champions Strand does not include a district-wide strategy component, it does comprise participants from districts across the entire Bay Area. Thus we believe that Champions' responses related to district leadership and culture serve as a comparison group—one that represents a broad range of perspectives of teachers working in districts that are not part of BaySci's district-wide programming. Accordingly, this section includes both the survey responses of BaySci District Strand and of Science Champions Strand participants. However, in using Science Champions as a control group a caveat applies: the competition for entry into this program could mean that these teachers are a special subset of educator leaders who are more aware of the resources available to them than typical teachers.

The surveys and interviews addressed leadership and culture in schools and districts. This section describes the conditions of leadership and culture in BaySci districts and Science Champions Strand members' districts.

Vision and reality

We asked teachers and administrators about the degree to which district and school leaders communicated a vision for science with school staff and the degree to which school and district leadership communicated clear messages prioritizing science. Responses to the two survey items related to these questions are summarized in Table 8 (below). Appendices A and D provide more detail on responses to the survey item described in this table and all other survey items related to leadership and culture described in this section.

Table 0-1. Summary of survey responses concerning district vision.

Statement	Percent of survey respondents [1] who selected "strongly agree" or "agree"		
	District Strand	**Science Champions Strand**	**All Respondents**
There are shared expectations and a common vision among staff concerning science instruction.	53%	45%	50%
The importance of including science curriculum has been clearly communicated to all teachers by school leadership.	59%	30%	49%

[1] This item was included in both the teacher and administrator version of the survey.

Across all survey respondents, about half agreed or agreed strongly with the positive statements concerning a common vision for science in their school or district. Respondents in the District Strand “strongly agreed” or “agreed” with the two positive statements about district vision more often than did respondents in the Science Champions Strand. This finding is consistent with the District strand efforts to work with district leaders on articulating and sharing a vision and plan for science in their districts.
Interview data illuminated both positive and negative impressions of school and district visions for science. Some participants from both the District strand and the Science Champions strand noted appreciation that science remains a priority despite the pressures schools and districts face to show progress in other areas (math and ELA).

Because of the importance of strong results in math and ELA, one District Strand participant felt the district-wide strategy of integrating science with ELA demonstrated a commitment to science. Another interviewee—one who reported strong school leadership in support of science—was concerned that the district vision for science could be threatened by pressures to adapt to the Common Core:

> […]in some ways, science is more of a priority in our district than it probably is in other districts. So teachers are teaching more science than they were, the program is slowly going down the ranks. However, now with Common Core coming in, I'm afraid BaySci and the FOSS program will get pushed aside. Here we've adopted the Next Generation Science Standards, which BaySci helps us achieve and we've put in all this work. I just hope all that doesn't get put aside to just . . . [meet] Common Core goals.”

Another district strand participant noted that relatively strong performance on state assessments enhanced the district’s ability to support science:

> The district and school have been good about not letting science fall away as other pressures mount. . . . the scores are good, they can take time for science.

Two District Strand participant interviewees reported mixed district commitment to science, in particular that in setting priorities it competes with subjects that are tested more frequently. One stated, “You can really sense the pressures to be ready for state testing—there is a fear of encouraging people to try new things.” Another teacher noted that professional development time previously spent on science was spent this year in preparation for adopting Common Core standards.

Although many Science Champions interviewees reported support for science in their schools, the most negative statements on this topic came from this group. This suggests that BaySci districts may be resisting pressures to abandon science for math and ELA more often than non-BaySci districts are. To illustrate, one champion claimed that at the district level there was no support for science, and another reported that the district-level director of instruction had told her that "the whole purpose of science is to help children learn how to read nonfiction."

Overall, respondents to interviews acknowledge a broad range of challenges that districts face in prioritizing science within the current school policy climate. Despite this, many praised districts for their efforts to maintain focus on science and support science instruction.

Leadership

In addition to the survey items referenced above, which relate both to vision and leadership, survey participants were asked to rate their level of agreement with three statements about leadership in their schools. Table 9 summarizes survey responses to these items.

Table 0-2. Summary of survey responses concerning leadership.

Statement	Percent of survey respondents who selected "strongly agree" or "agree"		
	District Strand	**Science Champions**	**All Respondents**
Teachers consider me a resource to address their technical or pedagogical needs for science instruction.	56%	60%	57%
Teachers know where to get their technical or pedagogical questions answered for science instruction in the classroom.	37%	47%	44%
There is a clear channel for communicating my science education needs in my school or district.	56%	63%	58%

Survey data suggest that teachers participating in BaySci professional development have assumed leadership roles in their schools and districts. In surveys we asked teachers to rate their agreement with the statement, "Teachers consider me a resource to address their technical and pedagogical needs for science instruction." In both the District Strand and the Science Champions strand, nearly 60% of respondents selected "strongly agree" or "agree," with Science Champions participants selecting "agree" or "strongly agree" more often. That response rate may be attributable to the Science Champion competitive application process; one of the criteria for selection was a record of science leadership in the applicant's school (AY 2013-2014 had two teacher applicants for every available seat.)

In interviews, we explored two topics related to science leadership: the leadership roles that respondents and other BaySci participants had taken on within their schools and districts since participating in BaySci, and respondent satisfaction with other school and district leader's efforts to support science.

Leadership roles of BaySci participants

Interview data collected from District Strand participants made it clear that long-term participants in BaySci, particularly those who had served on leadership teams, understood the logic underlying BaySci's science strategy. For example, several participants referenced the Lawrence Hall of Science's work to highlight overlaps between NGSS and Common Core requirements—overlaps that BaySci wanted practitioners to understand and that would encourage educators to spend more time on science. This type of knowledge, developed over the course of participating in BaySci, may help prepare participants for leadership roles in their schools and districts.

Teachers and administrators reported that participants in BaySci programming, particularly those in districts participating in BaySci for several years, were taking on increased responsibility to support science improvement in their schools and districts. Several teachers told us about professional development programming they had led for peers at their schools. Interestingly, three participants in the BaySci District Leadership Academy were not aware when they agreed to participate that they would be expected to lead professional development in their schools and districts. Despite the voiced concerns of several teachers that they were not ready to serve in this capacity, all three did end up leading professional development for others.

When BaySci participants took on leadership roles in their schools or districts, the capacities they had developed could become more evident to their school communities. One teacher who had not led professional development noted that several BaySci participants had taken an active role in bringing core ideas from BaySci back to the district. One district level administrator said that once teacher-leaders began offering professional development to peers, they started to get more requests for help from other colleagues requesting training and support.

Leadership Support for Science

Several District Strand interview respondents indicated that district leadership was strongly supportive of science. One respondent believed that despite pressures to ramp up with Common Core, district science leaders had made important progress:

> There is a mix of priorities around science as far as our district goes. On the one side we have amazing leaders in the district science department in [names individuals] . . . [that] brought on BaySci and has got it working in the majority of [District's] schools—which is an impressive accomplishment.

Some other participants in the District Strand told us that district level administrators were supportive of science. In this regard, some districts established new school or district level positions such as a BaySci coordinator or other district level science specialist. One teacher told us that her district's BaySci coordinator had worked with her directly to plan Life Sciences activities for her classroom. In addition to leading professional development for peers, BaySci teachers reported other kinds of leadership in their schools and districts such as sharing materials and advocating for inquiry science at key decision points.

Science resource specialists were often an important component of science leadership. One interviewee appreciated the increase in the number of science resource specialists per teacher. Another science specialist from the same district told us that the lower ratios allowed her to take time to communicate with classroom teachers about how to align their work better and prepare materials and supplies more effectively. A science resource specialist in a different district explained the importance of her role to the schools: her budget of about $5 per student (for 600 students) allows for caring for animals, insects and plants—additional work that could be quite onerous for classroom teachers

Two District Strand respondents and one Science Champions Strand respondent believed that their superintendents were engaged with science. One District level respondent thought her superintendent's focus on science since the district joined BaySci had marginally increased. Despite the slight improvement, this teacher characterized the leaders' discourse around science as "more like 'you're the teachers, make it happen,' not 'let's all get together and find out what we need to do to make it happen.'"

One District Leadership Team participant expressed frustration that high-level leaders in her district often failed to attend leadership team meetings.

Turnover among school and district leadership was of concern to some teachers. One teacher told us about a supportive principal who is retiring this year, and another was concerned that high-level district leaders who focused on science and NGSS had left and were being replaced with new people who focused on the Common Core. BaySci leaders at the Lawrence Hall of Science have been tracking of turnover in key district level science leadership positions since districts began participating in BaySci; that tracking indicates 22 job changes among 33 positions. Accordingly, BaySci's efforts to develop strong district leadership teams must be designed to adapt to high turnover. Similarly, teachers and other school staff must be prepared for changes in expectations and leadership on an ongoing basis. The concerns about leadership turnover were consistent across both years of interview data. An allied concern was that priorities change with new leadership. It is difficult for teachers to commit to a particular programmatic direction when substantial uncertainty surrounds how long it will last.

Several teachers told us that when principals serve as instructional leaders, they can have important positive effects on science instruction. As one District Strand participant reported, "A supportive principal. That makes all the difference." She went on to describe a prior principal who told teachers not to teach science. Her current principal "makes sure that science is on the agenda." This teacher came to her new position with the goal of teaching every FOSS unit at her grade level and stated that the support of her principal made that possible because she was allowed to spend more time on science.

When asked about leadership supports for science, Champions also often cited local school-level supports. If they mentioned district leadership, it was often to draw contrasts with strong school-level leaders or to note that their district level leadership allows them autonomy in making their own science-related choices.

Instructional Improvement Capacities

Survey participants were asked questions about instructional improvement capacities related to curriculum, materials, and access to professional development. Table 10 (below) summarizes their responses to these items.

Table 0-3. Summary of survey responses concerning instructional improvement capacities.

Statement	Percent of survey respondents who selected "strongly agree" or "agree"		
	District Strand	**Science Champions**	**All Respondents**
There are enough pedagogical materials (e.g., textbooks, other media) available to meet my needs for science.	61%	68%	64%
There are enough other science materials (e.g., well-stocked kits) available for class and lab activities.	75%	74%	74%
There is support available from my school or district for addressing any challenges I face in science instruction.	58%	65%	60%
The school supports teachers in participating in professional development activities related to science.	84%	79%	82%
The district supports teachers in participating in professional development activities related to science.	75%	77%	76%

The BaySci District Strand works with districts to improve access to curriculum and materials for K-8 science to ensure that teachers can easily work with the FOSS curriculum. When resources are available, BaySci helps districts establish materials management programs. The majority (61%) of District Strand survey respondents reported that they had sufficient access to pedagogical materials in their schools and an even higher percentage (75%) reported adequate access to materials and supplies. Champions Strand participants also reported high levels of access to materials and supplies.

Four District Strand interviewees and one Champions Strand interviewee praised the materials management systems adopted in their schools or districts as a result of BaySci efforts. Teachers are encouraged when they can carry out activities knowing that consumable resources have been replaced and need not be cataloged and counted. One teacher reported that the new materials management system, a schedule of rotating kits between classrooms, keeps her on schedule with science. One teacher participant in the Science Champions Strand lamented that her district had no materials management in place.

A participant in a District that is new to BaySci reported having a budget for consumable materials and supplies. Similar to the circumstances described by one district's teachers before BaySci was implemented, a motivated teacher could make science programming happen but considerable effort was needed to prepare for science lessons. The materials management policies that BaySci helped districts implement have obviated many of teachers' day-to-day materials struggles, allowing them to focus on other aspects of science instruction.

Policies and Priorities

We asked BaySci participants about policies and priorities that facilitate science instruction at both the school and district levels. Table 11 (below) presents a summary of responses to these items.

Table 0-4. Summary of survey responses concerning instructional improvement capacities.

Statement	Percent of survey respondents who selected "strongly agree" or "agree"		
	District Strand	**Science Champions**	**All Respondents**
My school has made policies that facilitate science instruction in the classroom.	41%	45%	42%
My district has made policies that facilitate science instruction in the classroom.	47%	45%	46%

Teachers agreed or strongly agreed that their schools and districts had enacted policies that facilitate science instruction 42% of the time and 46% of the time respectively. Teachers who did not select "strongly agree" or "agree" were split nearly evenly between "neutral" and "disagree" or "disagree strongly."

Interviewee comments on policies for science generally focused on whether teachers were allowed or required to spend class time on science. Positive comments in this area fell into two categories: those who believed that complete autonomy was important for their science instruction and those who valued standards and expectations for science instruction. Several participants in the Science Champions Strand (and one in the District Strand) reported that teachers in their school could make their own instructional choices concerning what to teach and how much time to spend on science. These teachers viewed that autonomy as allowing them to take time for science.

Several District strand respondents told us that there was a shared expectation for science instruction, either in their grade-level teams, in their schools as a whole, or across their districts. In these cases, all teachers were expected to offer science or all teams of teachers offered science with students rotating between teachers. Two respondents from the same district cited centralized guidelines for the quantity of science instruction at the district level:

> The district also has a science department now and they set the guidelines on the amount of science we need to teach each week." Later, she indicated that compliance was not monitored and that no mechanisms exited for tracking the amount of science taught.

Despite the guidelines, interviewees often reported that their peers did not always offer science. In one district, a teacher told us that kits are often returned after their scheduled time unused with all of the original materials (including consumables) in place. One science specialist teacher told us that some teachers do not offer the minimum 1-hour of classroom science (intended to complement her hour of hands-on activities) that is planned. Many interviewees thought it was important that all students receive science instruction that meets school or district expectations.

One principal told us that there were accountability structures in place to ensure that every teacher offers science. Because use of science notebooks is required throughout the school and because notebook use provides a concrete artifact documenting student work in science, the school is able to ensure that each student has some science instruction on a regular basis. One District Strand participant told us that accountability associated with science instruction varied depending on the grade level, with expectations for science instructions in place only in the grades where science is tested.

Contextual Conditions

Several teacher interview respondents commented on contextual conditions that influence science programs. Three teachers in schools that were in District Strand districts and one Science Champions Strand member noted that parent communities had been important advocates and supporters of science in their communities. Respondents noted that community support had at times been important for science program continuity, serving to maintain school and district leadership attention on science during times when that attention was waning elsewhere.

One teacher in a participating district mentioned that before BaySci she did not have to buy materials and supplies for science instruction because parents in her school provided enough financial support directly to teachers to pay for science materials and supplies. Another District Strand teacher mentioned that a previous principal had proposed eliminating science to allow more time for ELA. Concerned teachers engaged the community of parents on this issue and were able to prevent it.

Outcome 2. Changes to Instructional Practices

Both BaySci's District Strand and Science Champions Strand aim to improve access to high-quality science instruction in Bay Area schools by improving both the quantity of and quality of science instruction offered. Below we describe our findings related to science instruction and changes in science instruction that participating teachers and their administrators reported since joining BaySci.

Evaluation Goal 2

Describe changes to K-8 **instructional practices** in science in the districts participating in the BaySci District Strand, as well as more localized changes in the sphere of influence of members of the BaySci Science Champions Strand.

Aligns with Outcome 2: Improved elementary science instructional practices. Teachers participating in BaySci programming have improved confidence and a knowledge base for science learning and science teaching, and they apply a range of effective strategies.

Quantity of science offerings

BaySci seeks to support districts and teachers in prioritizing science instruction with the goal of increasing the frequency of that instruction and the duration of science lessons. At several points during the evaluation data collection, we asked teachers and administrators about how much science they offered to learn about changes in the frequency and duration of science offerings since BaySci was implemented.

The fall 2013 survey asked teacher respondents about the amount of science they taught at the time of the survey and the amount they had taught before they started participating in BaySci. For each of these items, we asked about science instruction in a typical week. We also addressed the amount of science taught in a short follow-up survey administered at the end of AY 2013-2014. As a result, we have assembled data approximating three time points: pre-BaySci , fall 2013, and spring 2014. When comparing data from the three time points, it is important to remember the limitations of comparing the pre-BaySci data, which are based on teachers' recollections about their teaching practices in the past, with the other time points in which the teachers were asked to report on current practices (and thus were likely to be able to do so more accurately).

Teachers surveyed were asked to report on the quantity of science offerings in terms of both the frequency of science lessons (in a typical week) and the duration of those lessons. We used these two data points to calculate a typical number of minutes of science per week for each time period. Only those teachers who reported a change in the amount of science they had offered before BaySci was implemented were asked to provide the frequency and duration of their pre-BaySci science lessons.

Tables 12 and 13 provide details on the instructional time for science reported in the surveys. Because district policies concerning time for science vary, the data from the District Strand have been broken down by district. Note that averages shown in the table include teachers who responded that no change had occurred in the amount of science they taught since they joined BaySci. Those teachers are considered to have zero change in duration and frequency. The tables indicate how often respondents report offering science, how long typical lessons last, and typical weekly minutes. Table 12 incorporates the responses of all survey participants. Because a larger proportion of science specialists responded to the spring survey (compared with the fall survey), the comparison between times reported for spring and fall is conflated with the differences between teaching assignments of respondents. Science specialists usually offer more science lessons each week than do classroom teachers. For this reason, Table 13 provides similar data but excludes responses from science specialists.

Table 0-5. Instructional time for science. Source: BaySci surveys, all teacher and science specialist respondents**.

	Pre- BaySci*	Fall Survey	Spring Survey**	Change from pre-BaySci to Fall	Change from Fall to Spring**	Total Change
Average frequency of science lessons weekly						
Champions	3.5	3.41	6.2	-0.09	+2.79	+2.7
Alameda	3.06	2.83	3.86	-0.23	+1.03	+0.8
Newark	2.58	3.01	2.38	+0.43	-0.63	-0.2
Oakland	2.91	2.64	4	-0.27	+1.36	+1.09
Orinda	3.5	3.2	3	-0.3	-0.2	-0.5
Petaluma	3.09	3.29	5	+0.2	+1.71	+1.91
Santa Clara	3.5	3.2	2.5	-0.3	-0.7	-1
AVERAGE	**3.3**	**3.19**	**5**	**-0.11**	**+1.81**	**+1.7**
Average duration of science lessons in minutes						
Champions	45.3	49.8	50.33	+4.5	+0.53	+5.03
Alameda	48.4	48.7	47.86	+0.3	-0.84	-0.54
Newark	37.7	41.7	46.88	+4	+5.18	+9.18
Oakland	57.7	60	53	+2.3	-7	-4.7
Orinda	42	48	56	+6	+8	+14
Petaluma	61.6	70.4	53.75	+8.8	-16.65	-7.85
Santa Clara	43.5	48.5	50	+5	+1.5	+6.5
AVERAGE	**46.9**	**51.4**	**51.32**	**+4.5**	**-0.08**	**+4.42**
Average weekly minutes per teacher (frequency x minutes averaged over all respondents)						
Champions	156.8	169.3	291.33	+12.5	+122.03	+134.53
Alameda	136.2	126.7	183.57	-9.5	+56.87	+47.37
Newark	104.9	130.9	113.75	+26	-17.15	+8.85
Oakland	171.8	157.7	211	-14.1	+53.3	+39.2
Orinda	154	156	150	+2	-6	-4
Petaluma	178.9	217.1	232.92	+38.2	+15.82	+54.02
Santa Clara	130.5	139.5	126.67	+9	-12.83	-3.83
AVERAGE	**151.1**	**160.8**	**240.29**	**+9.7**	**+79.49**	**+89.19**

* As reported in the fall survey

** Note that a higher proportion of science specialists responded to the spring survey across respondents from both strands; science specialists offer science lessons more frequently than do classroom teachers

Table 13. Instructional time for science. Source: BaySci surveys, classroom teacher respondents only (science specialist teachers excluded).

	Before BaySci*	Fall Survey	Spring Survey	Change from Before to Fall	Change from Fall to Spring	Total Change
Average frequency of science lessons weekly						
Champions	3.44	3.37	2.80	-0.07	-0.57	-0.64
District Strand Total	3.17	3.11	2.79	-0.06	-0.31	-0.37
Alameda	3.67	3.08	3.50	-0.58	0.42	-0.17
Newark	2.62	2.90	2.43	0.29	-0.47	-0.19
Oakland	2.97	2.89	3.33	-0.08	0.44	0.37
Orinda	3.50	3.20	2.50	-0.30	-0.70	-1.00
Petaluma	3.05	3.20	2.75	0.15	-0.45	-0.30
Santa Clara	3.35	3.40	2.50	0.05	-0.90	-0.85
TOTAL	**3.37**	**3.23**	**2.80**	**-0.14**	**-0.43**	**-0.57**
Average duration of science lessons in minutes						
Champions	43.77	49.12	51.86	5.35	2.73	8.09
District Strand Total	48.64	53.00	53.68	4.36	0.68	5.03
Alameda	44.58	46.25	47.50	1.67	1.25	2.92
Newark	38.93	45.00	45.00	6.07	0.00	6.07
Oakland	56.67	47.92	53.33	-8.75	5.42	-3.33
Orinda	42.00	45.42	58.75	3.42	13.33	16.75
Petaluma	64.67	45.00	66.25	-19.67	21.25	1.58
Santa Clara	42.50	45.42	50.00	2.92	4.58	7.50
TOTAL	**47.58**	**51.26**	**52.64**	**3.68**	**1.38**	**5.06**
Average weekly minutes per teacher						
Champions	151.39	166.75	141.86	15.36	-24.90	-9.54
District Strand Total	151.85	161.70	143.53	9.85	-18.17	-8.32
Alameda	165.00	140.00	164.17	-25.00	24.17	-0.83
Newark	94.41	138.75	112.86	44.34	-25.89	18.45
Oakland	168.67	153.75	176.67	-14.92	22.92	8.00
Orinda	154.00	161.25	131.25	7.25	-30.00	-22.75
Petaluma	192.67	164.17	161.25	-28.50	-2.92	-31.42
Santa Clara	138.00	165.42	126.67	27.42	-38.75	-11.33
TOTAL	**155.32**	**163.97**	**142.57**	**8.65**	**-21.40**	**-12.74**

* As reported in the fall survey.

Between the first two time points (pre-BaySci to the time of the fall survey), the full group of BaySci participants reported that they spent more time teaching science but that the overall increase in minutes was entirely attributable to increases in lesson duration. Excluding the science specialists (Table 13), we see an overall reduction in weekly minutes, but again there is a reduction in the frequency of lessons and an increase in the duration. The number of times teachers offered science each week (frequency) declined overall by an average of 0.11 lessons per week. For teachers transitioning to FOSS from a less inquiry-oriented approach to science, increasing the duration of lessons was the only way to ensure time was available for meaning making and closure at the end of a lesson. From a strategic point of view, this result poses questions about how best to approach further increases in the overall quantity of science in schools. Instructional leaders may need to choose between focusing on increasing frequency, on duration, or maintaining emphasis on both in further efforts with teachers.

The differences between the values in Tables 12 and 13 reflect the fact that much of the overall increase in the frequency of science lessons was reported by science specialist teachers and that their rate of survey participation was different in the two surveys. This complicates comparison between the time points for both the District Strand and Champions Strand participants (both of which include science specialists). Despite the overall reduction in weekly minutes reported, when we look at classroom teachers alone, we find that the length of a typical science lesson also increased. The data on the amount of science being taught across all respondents reinforce the idea that science reform takes time. The two districts that have participated in BaySci the longest, Newark and Petaluma, show the largest increases in time spent on science.

Respondents in the Alameda and Oakland districts reported reductions in the amount of time they spent teaching science. Several teachers in these districts reported large decreases in the frequency of science instruction (from 4-5 times per week to 1-2 times per week). In those districts, some teachers do offer more frequent science instruction, but their increases are more than counterbalanced by the large decreases reported by their peers.

Although we conclude that the numbers represented in these tables tell an accurate story about the time BaySci participants spend teaching science, we caution against comparing the numbers of minutes of science instruction reported by teachers across different districts or interpreting those numbers to reflect directly on the amount of science offered to students. In some districts, across both strands, teachers reported that team teaching was common, with a single teacher in a cohort offering all of the science instruction in a grade level. In other districts, all teachers taught science only to their own students. Because the teachers who do not offer science are unlikely to be BaySci participants, we do not believe this difference is corrected across many respondents. Some of the variation in weekly minutes of science instruction teachers offer may be related to differences in how the responsibility for science instruction is distributed among teachers.

To probe this question further and better understand how responsibility for science instruction is distributed, we asked survey respondents in the spring follow-up to indicate who teaches science in their schools. Table 14 shows that team teaching, with a single teacher responsible for science, is a relatively frequent strategy (18% of respondents reported it).

Table 0-6. Teacher responses to "How is science teaching organized in your school at your grade level(s) this year?" Source: Spring follow-up survey, N=83).

Structure for science instruction	Percent of respondents *
Students go to a science specialist on a regular basis.	**28.92%** (24)
Most classroom teachers teach science for their own students regularly.	**68.67%** (57)
One teacher in my grade level teaches science with all students at the grade level.	**18.07%** (15)

*** Raw numbers are indicated in parentheses.**

Responses to this survey item suggested a fourth common format that we did not ask about. In some grade-level teams, all teachers offer science, but each teaches only a single FOSS unit several times each year, with students rotating among teachers.

Interview data provide further detail on changes to the amount of science being taught. In interviews, the teachers who reported large increases in the amount of science they taught cited integration with ELA as an important factor in allowing increases in science. Their responsibility for spending significant class time on ELA had limited their capacity to teach science before they started integrating the work with ELA. The BaySci staff in both the District and the Science Champions Strands have worked consistently with teachers and district leaders to encourage this kind of integration as a way of increasing the amount of science instruction overall.

Among teacher interviewees who told us there was no change in the amount of science they taught, two common reasons were given. Some of the teachers who reported no change worked in grade-level teams according to one of the team-teaching scenarios described above. When students rotate in and out of classrooms for science instruction, teachers cannot make changes to the schedule without affecting their entire team. A spring follow-up survey teacher's comment addressed this point directly: "The other two 4th grade teachers switch classes for social studies and science. I keep everything self-contained so I have more time and flexibility in teaching." In this case, not participating in team-teaching arrangement gave more flexibility for scheduling science.

The other explanations that teacher interviewees frequently gave for not teaching more science was that they had already been offering a significant amount of science instruction before BaySci was implemented. Many stated that pre-BaySci, they had already been offering science four to five times each week Because both the District and the Science Champions strands are voluntary, it is not surprising that teachers who were already committing class time to science take part in the programming.

Quality of science offerings

To improve the quality of science instruction in participating districts and in the classrooms of Science Champions Strand members, BaySci seeks to implement more inquiry-oriented science (including more enactments of NGSS science and engineering practices), more science discourse, and more integrated science and ELA instruction.

Classroom observation data and surveys are the primary data sources concerning BaySci participants' quality of science offerings. Observations provide information about how classes are carried, showing us if and how teachers facilitate language-rich inquiry-science in their classroom, and surveys provide information about how frequently teachers rely on particular approaches and their comfort level with various aspects of science instruction.

Inquiry-oriented science

In both the surveys and observations, we addressed the degree to which NGSS science and engineering practices were enacted in science classrooms. The surveys questioned how frequently teachers asked students to engage with each of the practices. They also inquired if teachers were asking students to engage with the practices more frequently, less frequently, or the same amount as before joining BaySci. Tables 15 and 16 (below) summarize, respectively, District Strand and Science Champions Strand teachers' responses to these survey items. Percentages in the headers of both tables refer to multiple choice option text, (e.g. "Sometimes, in 30%-60% of science lessons").

Table 15. District Strand participants' self-reports on how often they asked students to engage with the NGSS science and engineering practices. Source: BaySci survey.

NGSS Science and Engineering Practices	How often do teachers report asking students to carry out NGSS practices?					More often since starting BaySci?
	Never/almost never (<10%)	**Rarely (10-30%)**	**Sometimes (30-60%)**	**Often (60-90%)**	**Always (>90%)**	
Asking questions and/or defining problems	0%	8%	29%	60%	16%	59%
Developing and using models	1%	29%	41%	38%	9%	43%
Planning and carrying out investigations	1%	16%	31%	45%	20%	44%
Analyzing and interpreting data	4%	11%	43%	39%	16%	60%
Using mathematics and computational thinking	10%	33%	35%	33%	8%	31%
Constructing explanations and/or designing solutions	3%	19%	37%	43%	15%	60%
Engaging in argument from evidence	5%	26%	36%	38%	16%	66%
Obtaining, evaluating, and communicating information	1%	10%	26%	53%	25%	72%

Table 16. Science Champions Strand participants' self-reports on how often they asked students to engage with the NGSS science and engineering practices. Source: BaySci survey.

NGSS Science and Engineering Practices	How often do teachers report asking students to carry out NGSS practices?					More often since starting BaySci?
	Never/almost never (<10%)	Rarely (10-30%)	Sometimes (30-60%)	Often (60-90%)	Always (>90%)	
Asking questions and/or defining problems	0%	11%	0%	38%	39%	80%
Developing and using models	3%	25%	0%	38%	30%	52%
Planning and carrying out investigations	0%	16%	0%	38%	41%	72%
Analyzing and interpreting data	0%	11%	0%	44%	41%	64%
Using mathematics and computational thinking	5%	28%	0%	47%	22%	39%
Constructing explanations and/or designing solutions	2%	16%	0%	39%	36%	80%
Engaging in argument from evidence	6%	14%	0%	38%	36%	80%
Obtaining, evaluating, and communicating information	2%	9%	0%	42%	27%	72%

Appendix B presents tables containing similar summary data on survey items related to enactments of science and engineering practices for each district.

Across both the District Strand and the Science Champions Strand, teachers reported that they often engaged students with the science and engineering practices; for almost all practices, more than half of teachers reported that they had increased the frequency with which they engaged students with the practice since beginning their work with BaySci. In both strands, the practices for which the smallest number of teachers noted an increase since joining BaySci were Using Mathematics and Computational Thinking and Developing and Using Models. The same two practices were most frequently coded as "never," "almost never," or "rarely" enacted in science lessons.

In our observations, we noted each time teachers asked students to engage with the practice, the nature of the activity and, when possible, how students then engaged with the practices. Table 17 (below) summarizes the proportion of the 37 classes observed in AY 2013-2014 that included each of the practices.

Table 17. Observed lessons including each of the NGSS Dimension I Science and Engineering Practices. Source: Classroom Observation Data.

NGSS Science and Engineering Practice	Teacher Requests or Student Engagement* 2012/13	Teacher Requests 2013/14	Student Engagement 2013/14
Asking Questions and Defining Problems	42% (24)	29.7% (11)	29.7% (11)
Developing and using models	46% (24)	32.4% (12)	16.2% (6)
Planning and Carrying Out Investigations	42% (24)	54.0% (20)	54.1% (20)
Analyzing and Interpreting Data	79% (24)	45.9% (17)	40.5% (15)
Using Mathematics and Computational Thinking	**	5.4% (2)	8.1% (3)
Constructing Explanations and Designing Solutions	54% (24)	51.3% (19)	56.8% (21)
Engaging in Argument from Evidence	25% (24)	13.5% (5)	13.5% (5)
Obtaining, Evaluating, and Communicating Information	58% (24)***	24.3% (9)	21.6% (8)

Note: Numbers in parentheses indicate total lessons observed.
* Combined for 2012/13 because we improved in our ability to distinguish these in the second year of observations
** Not included in 2012/13 observation protocol.
*** In one district, not included in the second year of observations, several teachers had trade books aligned with the content of the FOSS units

Observers agreed with the teacher self report from the surveys with respect to the practices most frequently observed in classrooms: asking questions and defining problems, planning and carrying out investigations, analyzing and interpreting data, and constructing explanations and designing solutions. Examples of how the science and engineering practices were captured in field notes of observers include:

- **Asking questions and defining problems.** In a large group discussion, one class reflected on a prior investigation involving batteries, light bulbs, and wires. Toward the end of the discussion the teacher facilitated a discussion about what questions remained following the investigation guiding the discussion toward examples of questions that could be explored in subsequent investigations.

- **Planning and Carrying out Investigations.** After completing three highly structured experiments with magnets, one class of students was invited to come up with their own questions and design experiments to explore their questions using materials available in the classroom. Students were instructed to write their research question, experiment plan (in steps), and experiment results in science notebooks.[6]

[6] In this and many other examples from our field note, a single classroom task can involve more than one science and engineering practice. Here we see students asking questions and defining problems, planning and carrying out investigations, analyzing and interpreting data, and developing and using models (students recorded their experiments in text and diagram form).

- **Analyzing and interpreting data.** In one class, where students had planted seeds several weeks prior, students developed labeled diagrams to record growth of plants and development of plants. In class discussion, students compared different species of plants to develop ideas around differences in the growth of each.

- **Constructing explanations and designing solutions.** In another class where students were working with plants, students dissected beans grown in the classroom. Students interpreted observations about the different beans and use prior knowledge to explain differences between them, then connect to prior knowledge.

In interviews, several teachers listed terms associated with science practices (e.g., use of evidence, constructing explanations, investigation) in their characterizations of how their instruction has changed since they began participating in BaySci. Others described a general transition from lecture format science lessons to classes featuring investigations and discussions. Several survey respondents credited BaySci's influence with their use of focus questions.

Integration of English Language Arts with Science

In the previous section we discussed the integration of science with ELA as a strategy for increasing the amount of time that teachers can dedicate to science. Here we discuss the integration of science with ELA as a means of supporting learning goals in both subjects.

Many teachers in both the District and the Science Champions strands reported that they were using science notebooks to integrate science and ELA and to support growth in both areas. Some teachers who were already using notebooks with their science instruction pre-BaySci told us that their use of notebooks had changed; whereas students may have recorded lecture notes in the past, teachers were now asking them to use their notebooks as lab notebooks to record ideas and observations.

Tables 18 and 19 (below) provide an overview of teacher self report on how often teachers assign students work that integrates their science studies with English language arts and whether they offer these kinds of connections between science and language arts more often than before participating in BaySci.

Table 0-7. District Strand participants' self-reports on how often they asked students to engage with activities linking science instruction with language arts. Source: BaySci fall survey.

Instructional Approach	How often do teachers report asking students to carry out NGSS practices?					More often since starting BaySci?
	Never/almost never (<10%)	**Rarely (10-30%)**	**Sometimes (30-60%)**	**Often (60-90%)**	**Always (>90%)**	
Working in science notebooks	**1%**	**1%**	**5%**	**22%**	**41%**	**69%**
Writing science reflections	**2%**	**2%**	**12%**	**36%**	**38%**	**71%**
Extended science reading	**4%**	**5%**	**25%**	**39%**	**27%**	**42%**
Other assignments that link science with language arts	**23%**	**6%**	**11%**	**35%**	**23%**	**36%**

Table 19. Science Champions Strand participants' self-reports on how often they asked students to engage with activities linking science instruction with language arts. Source: BaySci fall survey.

Instructional Approach	How often do teachers report asking students to carry out NGSS practices?					More often since starting BaySci?
	Never/almost never (<10%)	**Rarely (10-30%)**	**Sometimes (30-60%)**	**Often (60-90%)**	**Always (>90%)**	
Working in science notebooks	**0%**	**3%**	**3%**	**22%**	**37%**	**63%**
Writing science reflections	**0%**	**3%**	**17%**	**35%**	**35%**	**68%**
Extended science reading	**0%**	**8%**	**23%**	**35%**	**26%**	**38%**
Other assignments that link science with language arts	**11%**	**15%**	**8%**	**34%**	**26%**	**35%**

The survey data above indicate that across both strands of BaySci offering direct professional development to teachers, teachers assign activities that link science with language arts regularly and that for writing tasks in particular, a large number of teachers are integrating these approaches more frequently since participating in BaySci.

Additional activities that teachers reported (in a write in field) were varied and primarily comprised of additional reading and writing activities, and included internet searches related to science topics discussed in class, essay writing, science-themed poetry writing, vocabulary concept maps, pen pals from Mexico who study bird migration, and science fair reports with presentations.

Many teacher interviewees told us that they were engaging students in Science Talk or dialog with one another more often, and encouraging students to respond to one another's ideas and back up their own ideas with evidence.

We were interested in the degree to which physical classroom arrangements and configurations of students (e.g., in pairs, small groups) support dialog in science classrooms. For this reason, classroom observers noted when teachers gave students opportunities to interact with one another during science class and whether classrooms were arranged to facilitate instruction.

Observers identified distinct activities for each class observed and coded them as primarily individual, paired, small-group, or whole-class activities. Not surprisingly, the vast majority (87%) of classes began with a whole-class activity (often an introduction to the day's lesson and instructions for the day), and 43% of all activities observed were whole group activities. All classes observed had at least one additional distinct activity, and in 79% of cases the second activity was a small-group or a paired activity. In many cases, this second activity was the main hands-on investigation for the day. Across all activities, there was a mix of whole group, individuals and smaller group arrangements. Often this took the form of the teacher pausing small group activities to facilitate large group discussions by having students reflect on an investigation or draw connections between the current lesson and a previous day's lesson.

Table 20 (below) shows the breakdown of individual and group lessons. The varied configurations of students in the lessons suggest that teachers are giving students opportunities to interact with one another and that they have achieved a comfort level with classroom management outside whole-group arrangements.

Table 20.. Arrangement of students individually, in pairs, in small groups, or as a whole class in observed BaySci lesson activities. Source: observation data.

Arrangement of students	Percent and number of class activities
Individuals	**16.4% (35)**
Pairs	**12.2% (26)**
Small Groups	**28.2% (60)**
Whole Class	**43.2% (92)**
TOTAL	**100% (213)**

Observers coded each classroom according to the quality of the space available for facilitating interaction between students. Nearly all classrooms received high marks for adequate space and classroom arrangement to facilitate interaction. On the basis of teacher comments and observer notes alike, the most common shortcoming noted with classroom space has to do with overcrowding, which can make small group and paired activities difficult. One teacher told us that, unlike most school days, students were able to move around comfortably among the stations of an activity because several children were absent that day. Several teachers found that flexible arrangements encouraged interaction despite space limitations; some allowed furniture to be moved and others allowed groups to work outside or in the hallways

Overall Quality Ratings

As noted, the observation protocol addressed the level of inquiry science, the amount and quality of science discourse in classrooms, and the integration of science and ELA instruction. The protocol also included several quality metrics based on lesson design and implementation, appropriateness for English Language Learners, likely impacts of a lesson, classroom dynamics, and other factors. Observers rated lessons according to each of the above dimensions and then summarized all ratings as a single capsule rating. .

Table 21 (below) summarizes capsule ratings collected in observations carried out in AY 2012-2013 and AY 2013-2014.

Table 21. Observer capsule ratings of lesson quality. Source: Classroom observation records.

Observer Rating	Year 1: 2012-2013	Year 2: 2013-2014
Level 1: Ineffective Instruction	12.5% (3)	5.4% (2)
Level 2: Elements of Effective Instruction	4.0% (1)	10.8% (4)
LOW 3: Beginning Stages of Effective Instruction	12.5% (3)	5.4% (2)
MED. 3: Beginning Stages of Effective Instruction	36.0% (9)	8.1% (3)
HIGH 3: Beginning Stages of Effective Instruction	12.5% (3)	24.3% (9)
Level 4: Accomplished, Effective Instruction	20.0% (5)	35.1% (13)
Level 5: Exemplary Instruction	4.0% (1)	10.8% (4)
TOTAL	100% (25)	100% (37)

Outcome 3. Changes in the Capacity of Bay Area SREIs

> ### Evaluation Goal 3
>
> Analyze changes to **professional capacity within SREI institutions** to support science reform.
>
> **Aligns with Outcome 3: Improved capacity of SREIs to support science reform.** Participating SREIs form a learning community to expand expertise and improve the support they provide for science teachers and programs.

The SREI Learning Community aims to help SREIs build capacity to support schools and districts better. SRI observed SREI Learning Community programming and interviewed 11 participants to find out more about how the study groups, workshops, and other activities helped them build institutional capacity and relationships and improve understanding of district science needs and strategies for supporting them. In August of 2013, SRI submitted a memo on changes to the SREI professional community based on interviews with professional community participants. The memo included details of interviewee comments (see Appendix C). We have organized this section according to the three kinds of benefits SREI professional community participant interviewees reported: those for individuals, for the community, and for the work of SREI institutions. We have also summarized some formative evaluation data collected in the interviews.

Benefits to Individuals

SREI professionals reported a number of direct benefits they received from participating in the SREI Learning Community. Several participants valued having face-to-face time for conversations with colleagues and for finding out about the work of others. Newcomers to working in the SREI field enjoyed meeting new people, and veterans appreciated reconnecting and communicating face to face. As one interviewee put it, "The richness in having in-person meetings is that you can't overestimate the ability of conversation to breed rich 'a-ha' moments."

Participants who took part in the planning activities, all of whom reported working in the field for many years, appreciated the chance to work together. Although they may have been acquainted with one another, opportunities to think through challenges and get something done together were welcomed: "It was nice to work with these people and get their perspectives on these ideas and the way that they conduct workshops and design experiences."

Several people noted that SREI staff rarely have opportunities to participate in professional development, especially professional development relevant to the content offered by BaySci. Respondents noted that the programming included opportunities to learn about science discourse and NGSS. Even in institutions with high levels of staff capacity, it is uncommon for professionals to sit down and talk about recent articles. Without the workshop, one respondent would otherwise have just looked through the standards, without the broader sense of context that NGSS BaySci provided.

Community Benefits

For some participants, the SREI Learning Community provided opportunities to get to know other members of the professional community. Although those in more senior positions already knew many of their counterparts from other institutions, one director said that for the more junior people on the staff (program managers, etc.), the SREI activities afforded a good opportunity to meet their counterparts. One participant, who met at least three new cross-institution colleagues, intends to keep in touch with them.

Participants noted the importance of fostering the professional community and (re)discovering that everyone struggles with the same issues. They appreciated building a common vocabulary and hearing how other institutions responded to the challenges of their work.

A few respondents noted SREIs may compete, not only for funding but also for audiences. Building collaboration that extends beyond an individual institution therefore demands buy-in and support from high-level staff.

Two organizations have begun a partnership that was initiated through SREI strand participation. One interviewee explained that "Inverness has continued to nurture, foster, and broker (the partnership)" and told us that a department from Chabot Science Center spent the day meeting with their counterparts at the Monterey Bay Aquarium onsite at the Aquarium. The goal of this meeting was to learn how they could partner on the more detailed side of offering professional development, not just to promote one another's work.

Several interviewees remarked about the timeliness of the transition to NGSS topic for the challenges that institutions face today. Several respondents noted that the transition affords SREIs with a shared mission on which to work and collaborate. "NGSS is going to be a huge change, long overdue; but where teachers are and where they need to be is so far apart." Participants reported being interested in sharing how their institution is addressing NGSS with one another and learning what others are doing. After hearing what other groups were doing, many respondents indicated they were pleased by the strategies their institutions had adopted.

Similarly, the sessions on Science Talk were relevant too much of the work of the SREIs with schools. Participants reported encountering very different perspectives on Science Talk and benefitting substantially from the discussions.

Effects on the work of SREI institutions

Some SREI Learning Community participants took what they had learned back to their institutions to inform planning or the design of programming for schools and districts. One person reported that the conversations created "a rich breeding ground for development [of programming for educators]". Several SREIs were in the midst of redesigning offerings for schools and districts to align with NGSS.

Several people commented that, given extended programming development cycles , it was unlikely that much of what was learned in the sessions would be implemented immediately at the program level. Instead, such impacts are expected in the future. The SREI strand was therefore described as supporting transitions that are already under way through its effect on program design work.

Formative feedback

Several participants found the programming beneficial. Participants used phrases like "very worthy endeavor," and several commented on the overall quality of the programming. Topics and reading selections for study groups, as well as the overall content of workshops, were reported to be of high quality and relevant to the work of SREI professionals.

Two senior respondents commented that, given their familiarity with the readings, content of the study groups fell below their expertise levels. One of the two also noted the group's wide range of degree of interest and of knowledge in this topic area (signaling the challenge of designing programming that meets all needs).

Two participants wanted more emphasis on practice: One was interested in more training around the "nitty-gritty" for curriculum developers thinking about NGSS. Another said that reading the articles has been helpful, but additional information on the practice and what it looks like would be helpful.

Several others commented on logistical concerns for future programming. Some found the locations or schedule to be inconvenient, particularly for the 2-hour study group sessions for which travel time could exceed the length of the session.

The future of the SREI strand was of general interest. One respondent was "curious about where we're going to take it from here." Suggestions for the future included additional NGSS sessions (note that the interview took place before the additional NGSS sessions in December 2013 were announced), more involvement of guest speakers, and smaller group mentorship teams.

Overall, participants reported that they had gotten a lot out of the activities and that their participation would positively affect their work with schools and districts. Moreover, the commitment to continued participation was high.

Outcome 4. Changes to Student Learning and Engagement

All three strands of BaySci aim to contribute to outcomes that are expected to indirectly enhance student learning and engagement. Learning and engagement are expected to benefit from improved science instruction, which in turn is influenced by school and district leadership and SREI capacity. Figure 2, a simplified version of the logic model shown in Figure 1 above, outlines the two-step relationship that connects BaySci programming with student outcomes and the dependence of student outcomes on instruction.

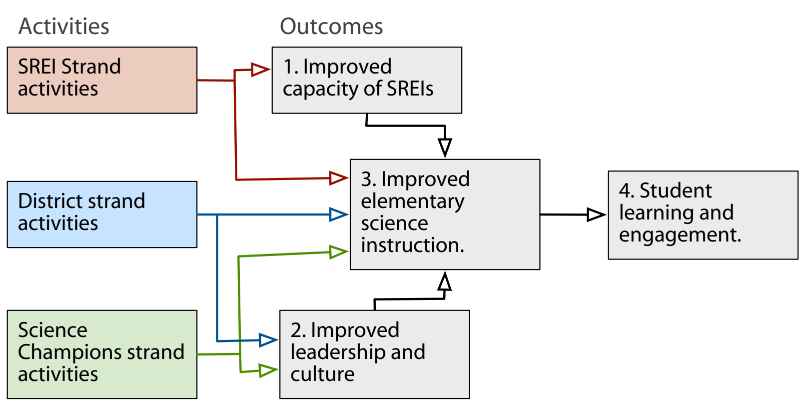

Figure 2. Simplified representation of the BaySci logic model highlighting the expected indirect impacts on student learning and engagement.

Evaluation Goal 4

Document student learning and engagement outcomes for students whose instruction is influenced by BaySci professional development or district leadership. Learning outcomes will be linked, when possible, to the Science and Engineering Practices.

Aligns with Outcome 4: Student learning and engagement
Students of teachers showing improved instructional practices learn core ideas, cross-cutting concepts, and science practice skills; and show improved attitudes, interest, and engagement in science

Although none of our data sources provided extensive information about student learning and engagement, we were able to draw inferences from four independent data sources. Test score data, available from statewide tests administered in AY2012/13, provided us with some information about student achievement. Classroom observation data, including records of student engagement with science and engineering practices, provided descriptive information about the nature of student engagement with inquiry science. Finally, surveys and interviews with classroom teachers included items on observed changes to student learning and engagement.

Science Learning

Under the California Standardized Test (CST) or Standardized Testing and Reporting (STAR) testing scheme, California students were tested in science for the first time in the fifth grade. Figure 3 is a graph showing the results of fifth-grade science test scores dating back to AY 2007-2008. (BaySci started in the following year). We included all districts that were a part of BaySci before 2012 for which multiple years of BaySci data are available. In addition to average scores for each district, we have included the average California score in the figure. Appendix E provides complete test score summaries for participating districts.

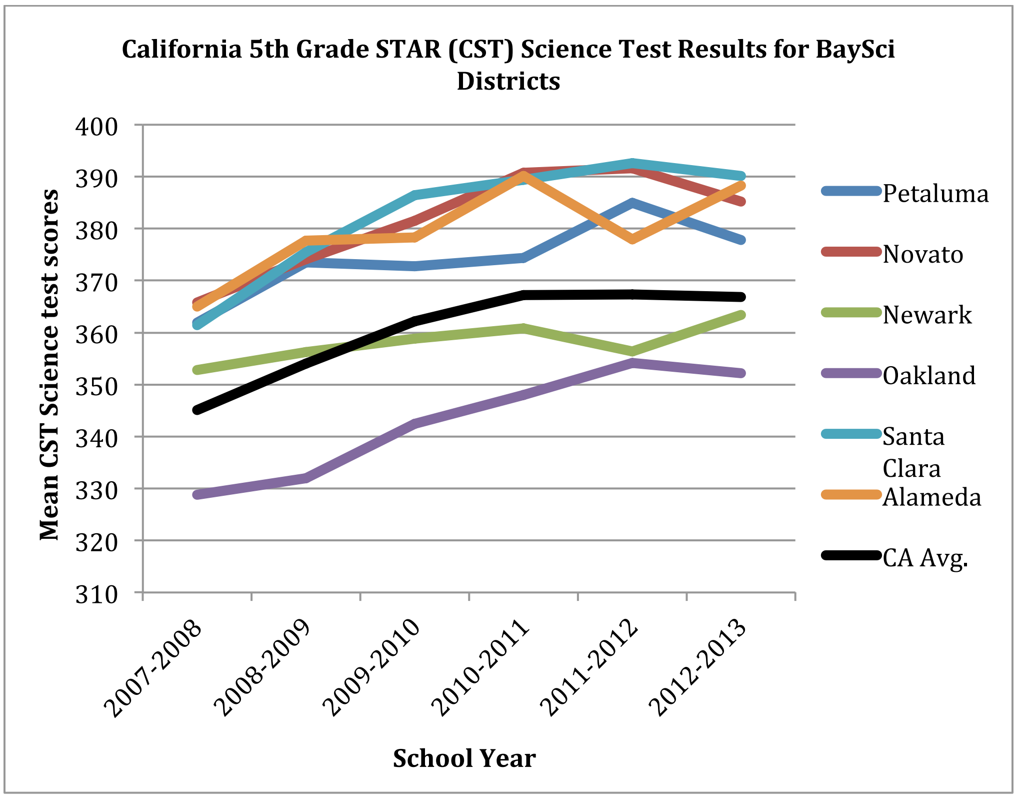

Figure 3. Average 5th grade science scores on the California Standardized Test, by district.

Table 22 (below) shows a summary of test score gains on the CST fifth-grade science test since AY 2007/08. Scores of districts not participating in BaySci at the time, are shown in grey. Districts with score gains greater than the statewide average are shown in bold.

Table 22. Table of California Fifth-grade STAR (CST) science test score gains for BaySci districts and California average.

Gains	Petaluma	Novato	Newark	Oakland	Santa Clara	Alameda	BaySci Participant Average	CA Avg.
Years in BaySci	**5**	**5**	**5**	**2**	**2**	**2**	**N/A**	**N/A**
Avg. Gain Since BaySci	**3.2**	**3.9**	**2.1**	**-2**	**-2.4**	**10.4**		**4.36 (5 yr.) -0.5 (2 yr.)**
2008-2009*	**11.6**	**8.3**	**3.5**	**3.2**	**14.1**	**12.7**	**7.8**	**8.9**
2009-2010	**-0.7**	**7.4**	**2.5**	**10.5**	**10.9**	**0.6**	**3.07**	**8.2**
2010-2011	**1.6**	**9.3**	**2**	**5.5**	**3**	**11.8**	**4.3**	**5**
2011-2012	**10.6**	**0.8**	**-4.4**	**6.2**	**3.2**	**-12.2**	**2.33**	**0.2**
2012-2013	**-7.2**	**-6.4**	**7**	**-2**	**-2.4**	**10.4**	**-0.1**	**-0.5**

***Numbers show in grey indicate score data for districts in years they were not yet participating in BaySci**

It is difficult to draw conclusions from the test score summaries. Figure 3 shows that test scores for all but one participating BaySci district started higher than the California average. Gains tended to be lower than average gains across the state, but much of that difference may be a consequence of the higher than average starting scores of BaySci districts. Appendix E, which presents more details on CST scores, includes a breakdown showing the percentage of students who scored in the advanced, proficient, basic, and below-basic. or far-below-basic categories. With the exception of the Alameda and Newark districts, participating BaySci districts saw gains in CST science scores not only in the highest categories (e.g., with proficient students moving up to the advanced level),but also with reductions in the numbers of students scoring below or far-below-basic. This suggests that test score gains in BaySci districts are indicators of change across a diverse range of students and is consistent with what one would expect from programming influenced by BaySci efforts to engage all students in science.

Engagement and Interest in Science

Student engagement and interest are critical for learning in a science classroom. Performing science practices effectively requires critical thinking that is only possible with a certain level of engagement. In surveys, we asked teachers to estimate the level of student engagement and interest in the science classes they taught before and after joining BaySci. Findings on how many teachers indicated 75% or above are summarized in table 23 (below).

Table 23. Survey response summaries for items related to student engagement and interest in science. Source: BaySci Fall Survey.

Survey Item	Prior to participation in BaySci	By the end of the last school year
About what percentage of your students seemed engaged during science instruction? (respondents 75% of students or more)	**74%**	**95%**
Roughly what percentage of the students you taught were interested in science? (respondents stating 75% of students or more)	**73%**	**95%**

Before their participation in BaySci, a significant number of teachers reported that fewer than 75% of their students were engaged during science instruction (26%). Following their BaySci training, the number of teachers that reported 75% student engagement or above in their science classes increased by 21%. This suggests that teachers believe that BaySci is helping them create engaging learning environments where students feel motivated to learn. Results were similarly positive when teachers were asked about student interest in science. For further insights into how BaySci programming helps teachers improve students engagement and interest, we look to interview data.

In interviews we asked teachers if they had any evidence that students were learning more or were more engaged now compared with before their participation in BaySci. Three teachers cited strong scores on science assessments as evidence that BaySci is impacting student achievement. Several teachers also commented on improvements in inquiry science practices, language development, and student engagement.

Many teachers commented on student engagement with inquiry science practices specifically. Teachers mentioned that students were getting better at using evidence to support their ideas, at questioning, at making observations, and at communicating information.

Teachers also mentioned verbal and written language skill development, which they attributed to changes in their instruction aligned with BaySci. Many teachers reported that they were pleased with student engagement in Science Talks, noting that students were getting better at things like sharing ideas, engaging in lengthy discussions, and taking the risk of being wrong. In one example, a teacher commented, “The discourse is a huge thing. They will be in a circle and I will give them a handful of sentence starters and they can talk with each other back and forth.” Similarly, another teacher appreciated that some of the students who are reluctant to talk say more once peers start modeling scientific discussion.

Many teachers commented on students’ improved writing and reading skills since adopting BaySci approaches in science classes, particularly since integrating ELA with science instruction. Teachers cited improved work in science notebooks, including more depth or detail, better use of scientific vocabulary, and an increased quantity of writing. A few teachers also commented that reading had improved due to the increased use of nonfiction reading materials.

In interviews, many teachers also commented that they noticed that students liked science lessons more than before the teachers participated in BaySci. One teacher commented that “students have always loved hands-on science. Even when I didn’t know how to teach it very well and didn’t really get the kits, they still loved it. But I think know that I know how to put it out there. I think they like it even more, they get more out of it”

Student interest in science may improve their level of general engagement with science. Several teachers commented on student willingness to work diligently in science class. In the words of one teacher who participated in both the District Strand and the Science Champions Strand, during goal setting activities students say that they want “to be better at science and understand things better.”

Discussion

Incorporating and analyzing the varied sources of data we collected on BaySci and looking across the three parallel strands of BaySci activity, we saw evidence of science education improvement aligned with each of the four BaySci expected outcomes from individual and institutional participants.

Our data suggest that science leadership and culture in schools and districts influenced by BaySci are strong; the more open-ended data obtained in interviews suggest that, although science continues to compete with ELA and mathematics for the attention of leaders, participating districts often have formulated and expressed a shared district vision for science. Similarly, we found that BaySci participants, including both Science Champions members and District Strand participants are taking on leadership roles in their schools and districts, sharing what they have learned with peers, and finding opportunities to influence science programming locally. Examples of this included some teachers who reported offering professional development for peers in their schools for the first time.

District Strand participant staff members' high ratings for support of science, instructional capacity, and policies are most likely linked to the specific BaySci strategies that were mentioned in interviews and in open-ended survey items. One key strategy has been supporting and encouraging districts to work with science specialists and other staff dedicated to science. Both the quantitative data on instructional time spent on science and the interview data on leadership for science indicate that science specialists are important for improving the amount of science offered in schools. Several participants in both strands of BaySci noted that they perceived the use of science specialist positions as a strong indication of district commitment to science and an approach that facilitates science improvement. Respondents also acknowledged BaySci support for districts in developing systems for materials management, both as a sign of leadership commitment and as a development that supports teachers who are interested in offering more science. Other key strategies that BaySci designers promoted and that survey and interview respondents cited frequently included the development of policies such as the promulgation of district standards or school-wide expectations concerning teachers' commitment to particular units of study, the time to be spent on science, and instructional approaches (e.g., notebook use).

Our exploration indicated that participating teachers in BaySci districts reported spending more time on science than they had pre-BaySci, but that those gains primarily resulted from longer lessons rather than from more frequent lessons. We also found that, despite increases in the length of typical science lessons, the overall time classroom teachers reported spending on science declined between the fall and spring data collections. (Science specialists were not taken into account in this analysis.) The decline may reflect the seasonal cycle of the school year, which often includes test preparation and increased time on state tested subjects in the spring, or other contextual factors such as materials running out or needing to be returned before the end of the year. The greatest increases in time spent on science were reported by participants in the two districts that have been with BaySci the longest, suggesting that the kinds of changes BaySci is targeting may take more than a year or two to take hold. These districts were also the only ones where overall gains in both the frequency and duration of science lessons took place.

Changes in instruction reported by participants and instructional quality observed in classroom observations aligned with key areas of the BaySci professional development interventions. Teachers in both District Strand and Science Champions Strand reported engaging students with the Science and Engineering Practices more often than before joining BaySci and assigning tasks that included integration of science with ELA. The vast majority of observed BaySci classrooms received quality ratings of effective or better instruction.

Participants in the SREI Learning Community reported a wide range of benefits that they links with their participation in BaySci, many of which have direct implications for their capacity to provide needed support to schools and districts. Learning community members built professional relationships with peers in other institutions, learned about cutting-edge research on topics of direct interest to their school-based constituents, and developed interests in new directions for their work in schools.

In comparison to the other three outcomes, the data on student learning and engagement that the evaluation collected were more limited and indirect. Teacher interview and survey reports on student work in science indicated that many found their students more engaged and interested in science after their teachers began to participate in BaySci. Teachers specifically commented on improvement in student engagement in connection with inquiry science approaches. Teachers also noted improved student achievement. These improvements were not limited to achievements in science itself, however; teachers also reported that students showed improvements in ELA skills such as the ability to express ideas verbally or in writing during science lessons.

Consistent themes emerging from analysis of the open-ended data collected from across all three strands of BaySci indicate success of the program design feature of complimentary and parallel strands of BaySci programming. For example, as we described in the section on Outcome 2, teacher participants in both the District Strand and Science Champions Strand often described professional development in support of integrating science and ELA— science notebook use and Science Talk strategies, in particular—as examples of concrete changes in their science instruction since starting BaySci. Along similar lines, in our discussion of Outcome 3, we noted that many BaySci SREI Strand participants valued learning about current research on Science Talk and other ELA integration themes because these are areas where they recognized strong opportunities for supporting teachers, schools, and districts. Similarly, the reports of leadership development in both the District Strand and Science Champions Strand suggest a value of different approaches to developing science leadership depending on the level of institutional involvement. The Science Champions Strand has in this way been able to leverage assets in settings that are, at least at present, outside the reach of the BaySci District Strand.

Finally, viewing BaySci as a system, we see that needs and opportunities made evident in one strand of programming can be addressed in another. The Science Champions Strand, by fostering science leadership among teachers in districts that do not participate in BaySci (or districts that do not participate yet), helps to address needs outside of the scope of the District Strand, while at the same time, expanding the reach of BaySci to more communities. The parallel design of the multi-strand BaySci program allows each strand of activity to support science education improvement beyond what would be possible from the individual strands of activity.

Appendix A. Fall 2013 BaySci survey items with response summaries and response counts

Due to branching, different respondents saw different versions of the survey. Though items appear repetitive, each was only seen once by any individual respondent. Text at the top of a survey item such as “Q4=1” explains the branching (in this case that only respondents who selected the first option for Q4 will see the question). Items offered only to teachers are also numbered with T (e.g. T8, T9) while items for administrators are numbered with A. Items numbered with Q are offered to both of these groups. Q4, which asks what kind of job the respondent holds, was the question most frequently used in branching throughout the survey.

A count of each multiple-choice response is given with each option. For items that are not multiple-choice, response counts are provided. Note that number entry items (i.e. “How many minutes of science instruction do you offer…”) are described with response counts, not means.

BaySci
A Partnership for Bay Area Science Education

Teacher and Staff Survey

Introduction and Consent

Thank you for participating in this survey. This survey is being administered by the research and evaluation groups SRI International in partnership with Inverness Research. We are evaluating the BaySci project. The information you provide will be anonymous and we will not report on teachers or schools individually. Your participation is voluntary and you may choose not to participate at any time. If you have any questions before continuing with the survey, please contact Julie Remold at SRI International.

email: julie.remold@sri.com

phone: (650) 859-4136

The survey will take about 20 minutes to complete.

Do you wish to continue with the survey?

- ☐ Yes 181
- ☐ No 1

(Consent=2 – skip to end)

Part I. Participant

Q1 **Name:** *(Revise as needed.)*

181

Q2 **District:**

☐	Alameda USD	18
☐	Newark USD	13
☐	Novato USD	11
☐	Oakland USD	20
☐	Petaluma USD	18
☐	Santa Clara USD	13
☐	Palo Alto USD	3
☐	Other	71

Q2=8

Please specify:

66

Q3 **How many years have you participated in BaySci?**

(Include this year if you are currently involved.)

☐	1	108
☐	2	43
☐	3	13
☐	4	6
☐	5	11

Part I. Participant

Q4 **Are you a ...** *(Select all that apply.)*

☐	Classroom teacher *(not including science specialists)*	129
☐	Science specialist teacher	22
☐	School Administrator	11
☐	District Administrator	16
☐	Other	5

Q4=4

Specify your District Administrator position / title:

16

Q4=5

Please specify "other":

5

T4a Q4=1 or Q4=2

Grade(s): *(Select all that apply.)*

☐	K	28
☐	1	34
☐	2	36
☐	3	43
☐	4	54
☐	5	48
☐	6	8
☐	Other	5

T4a=8

Please specify "other":

3

T5 Q4=1 or Q4=2

How many years have you been teaching prior to this year?

(Enter a whole number only, enter "0" if this is your first year teaching.)

150

Part II. Science Instruction

T6 Q4=1 or Q4=2

How well prepared do you feel to teach each of the following subjects at the grade level(s) you teach? *(Select one response for each row.)*

	Not adequately prepared	Somewhat prepared	Fairly Well Prepared	Very Well Prepared
a) Science	4	15	67	64
b) Mathematics	3	10	64	71
c) Reading/Language Arts	3	17	53	74
d) Social Studies	13	37	57	90

T7 Q4=1 or Q4=2

Please indicate how well prepared you feel to do each of the following. *(Select one response for each row.)*

	Not adequately prepared	Somewhat prepared	Fairly Well Prepared	Very Well Prepared
a) Lead a class of students using investigative strategies	4	19	69	56
b) Manage a class of students engaged in hands-on/project-based work	2	16	58	72
c) Help students take responsibility for their own learning	1	23	66	58
d) Recognize and respond to student diversity	2	18	62	66
e) Encourage students' interest in science	1	7	51	89
f) Use strategies that encourage participation of females and minorities in science	2	28	57	61

T8 Q4=1 or Q4=2

Do you teach science or offer science activities to your typical student in a normal week?

- ☐ Yes 145
- ☐ No 4

T8a T8=1

Approximately how frequently do you offer science?

- ☐ every day 18
- ☐ about 4 times weekly 16
- ☐ about 3 times weekly 43
- ☐ about 2 times weekly 51
- ☐ about 1 time weekly 17

T8b T8=2

Approximately how frequently do you offer science?

3

T9 Q4=1 or Q4=2

Approximately how many minutes is your typical science lesson, including instruction and activity time?

Minutes *(Enter a whole number only.)*

148

T10 Q4=1 or Q4=2

In an average week, do your students have additional science instruction not taught by you?

☐	Yes	47
☐	No	102

T10b T10=1

Approximately how many minutes of this additional science instruction is provided per week?

Minutes *(Enter a whole number only.)*

45

A11 Q4=3 or Q4=4 or Q4=5

In your school or district, is there science instruction or science activity for the typical K-5 student at least once each week?

☐	Yes	27
☐	No	3
☐	Don't know	1

A11a A11=1

Approximately how frequently do students in your school or district have science?

☐	every day	1
☐	about 4 times weekly	5

- about 3 times weekly 9
- about 2 times weekly 10
- about 1 time weekly 2

A11b A11=2

Approximately how frequently do students in your school or district have science instruction?

3

A11=1

A11c1 Number of lessons per week with regular classroom teachers:

24

A11c2 Number of lessons per week with science specialists:

22

T12 Q4=1 and Q5>=1 or Q4=2 and Q5>=1

Has the amount of time you spend on science changed since you started participating in BaySci programming?

- Yes 75

- ☐ No 54
- ☐ not sure / not applicable 20

T12a T12=1

Approximately how frequently did you offer science (including instruction and activities) before you started participating in BaySci programming?

- ☐ every day 3
- ☐ about 4 times weekly 1
- ☐ about 3 times weekly 6
- ☐ about 2 times weekly 20
- ☐ about 1 time weekly 27
- ☐ less than one time weekly 18

T12a=6

How frequently?

12

T12b T12=1

How many minutes was your typical science lesson, including instruction and activity time, before you became a BaySci participant?

Minutes *(Enter a whole number only, enter "0" if none.) Note: please this leave blank if your position has changed significantly, e.g. from multiple subject to science specialist.*

74

t1A13 BaySci District Strand participants Only AND Q4=3 or Q4=4 or Q4=5

Do you think students in your school or district spend more time with science instruction and activities since your district started participating in BaySci?

- ☐ Yes 18
- ☐ No 2
- ☐ not sure / not applicable 7

t1A13a T1A13=1

Approximately how frequently did K-5 students in your school or district have science instruction or activities before your district started participating in BaySci?

- ☐ every day 0
- ☐ about 4 times weekly 0
- ☐ about 3 times weekly 1
- ☐ about 2 times weekly 1
- ☐ about 1 time weekly 11
- ☐ less than one time weekly 3

T1A13a=6

How frequently?

3

t1A13b_x t1A13=1

Comments:

3

Q4=1 or 2

Approximately how often do you ask students to carry out the following science practices? *(Select one response for each row.)*

Response options shown on next page.

NOT Q4=1 or 2

Approximately how often do teachers at your school or in your district ask students to carry out the following science practices? *(Select one response for each row.)*

		Not sure	Never / almost never (in fewer than 10% of science lessons)	Rarely (in 10-30% of science lessons)	Sometimes (in 30-60% of science lessons)	Often (in 60-90% of science lessons)	Always (in 90% or more of the lessons
Q14	**a)** Asking questions and/or defining problems	3	0	14	56	83	22
	b) Developing and using models	5	3	44	72	49	5

c) Planning and carrying out investigations	4	1	23	60	75	16
d) Analyzing and interpreting data	3	3	17	77	59	16
e) Using mathematics and computational thinking	4	11	49	75	37	3
f) Constructing explanations and/or designing solutions	4	4	26	67	61	17
g) Engaging in argument from evidence	3	8	32	63	57	15
h) Obtaining, evaluating, and communicating information	3	2	15	49	75	35

T15 Q4=1 and Q5>=1 OR Q4=2 and Q5>=1

Do you ask these things of your students more or less frequently than before you started participating in BaySci? *(Select one response for each row.)*

	Less frequently	No change	More frequently

a) Asking questions and/or defining problems	2	42	104
b) Developing and using models	1	76	71
c) Planning and carrying out investigations	0	59	89
d) Analyzing and interpreting data	1	51	96
e) Using mathematics and computational thinking	3	94	51
f) Constructing explanations and/or designing solutions	2	42	104
g) Engaging in argument from evidence	1	39	108
h) Obtaining, evaluating, and communicating information	0	41	105

t1A16a BaySci District Strand participants AND Q4=3, 4, or 5

Do you think teachers at your school or district ask these things of your students more or less frequently than before your district started participating in BaySci? *(Select one response for each row.)*

	Less frequently	No change	More frequently
a) Asking questions and/or defining problems	0	1	3
b) Developing and using models	0	1	3
c) Planning and carrying out investigations	0	1	3
d) Analyzing and interpreting data	0	2	2
e) Using mathematics and computational thinking	0	2	2
f) Constructing explanations and/or designing solutions	0	0	4
g) Engaging in argument from evidence	0	1	3

Q4=1 or Q4=2

Approximately how often do you assign the following to your students (including in class or at home)? *(Select one response for each row.)*

Q4=3 and NOT Q4=1 and NOT Q4=2 and NOT Q4=4 and NOT Q4=5

Approximately how often do teachers at your school assign the following to your students (including in class or at home)? *(Select one response for each row.)*

NOT Q4=1 AND NOT Q4=2 AND NOT Q4=3

Approximately how often do teachers in your district assign the following to your students (including in class or at home)? *(Select one response for each row.)*

		Not sure	Never / almost never (in fewer than 10% of science lessons)	Rarely (in 10-30% of science lessons)	Sometimes (in 30-60% of science lessons)	Often (in 60-90% of science lessons)	Always (in 90% or more of the lessons
Q17	**a)** Working in science notebooks	1	3	7	37	66	65
	b) Writing science reflections	2	4	24	62	65	22
	c) Extended science reading	4	11	42	65	51	6

d) Other assignments that link science and language arts	31	16	16	62	45	9

Q17d=3 or Q17d=4 or Q17d=5 or Q17d=6

Please specify other assignments:

132

T18 Q4=1 and Q5>=1 OR Q4=2 and Q5>=1

Do you assign these things more or less frequently than before you started with BaySci? *(Select one response for each row.)*

	Less frequently	No change / not sure	More frequently
a) Keeping science notebooks	1	48	10
b) Writing science reflections	2	43	104
c) Extended science reading	1	87	61
d) Other assignments that link science and language arts	1	94	54

T18d=1 or T18d=3

Please specify other assignments:

45

T19 Q4=1 and Q5>=1 OR Q4=2 and Q5>=1

Are there new strategies, in addition to those listed in the previous questions, that you adopted since getting involved in BaySci?

- ☐ Yes 88
- ☐ No 59

T19=1

Please describe the changes:

87

Part III. Student learning and engagement

The following questions are meant to inform us about student interest in science and student learning.

T22 Q4=1 and Q5>=1 OR Q4=2 and Q5>=1

By the end of last school year, about what percentage of your students seemed engaged during science instruction?

- ☐ 100% 71
- ☐ 75% 68
- ☐ 50% 6

- ☐ 25% 3
- ☐ 0% 1

T23 Q4=1 and Q5>=1 OR Q4=2 and Q5>=1

By the end of last school year, about what percentage of your students were interested in science?

- ☐ 100% 69
- ☐ 75% 72
- ☐ 50% 6
- ☐ 25% 1
- ☐ 0% 1

T24 Q4=1 and Q5>=1 OR Q4=2 and Q5>=1

Prior to your participation in BaySci, roughly what percentage of the students you taught seemed engaged during science instruction?

- ☐ 100% 46
- ☐ 75% 62
- ☐ 50% 38
- ☐ 25% 3
- ☐ 0% 0

T25 Q4=1 and Q5>=1 OR Q4=2 and Q5>=1

Prior to your participation in BaySci, roughly what percentage of the students you taught were interested in science?

☐	100%	45
☐	75%	65
☐	50%	37
☐	25%	2
☐	0%	0

Part IV. Student Assessment

Q26 **Are there any assessment approaches that are particularly valuable in giving you a sense of what your students are learning in science?**

- ☐ Yes 132
- ☐ No 45

Q26=1

Please specify:

129

Q27 T4a=6 or T4a=7 or Q4=3 or Q4=4 or Q4=5

Are the statewide science assessments useful for you in understanding what students have learned?

- ☐ Yes 26
- ☐ No 54

T4a=6 or T4a=7 or Q4=3 or Q4=4 or Q4=5

Please explain:

59

Part V. Climate for science at your school and district

The following questions are meant to inform us about how science fits with the leadership and culture of your school and district. For some questions, we'll ask you to compare things today with how things were before you or your district got involved in BaySci.

Please respond to the following:

t1Q28 BaySci District Strand participants

I talk with colleagues and others at my school or district about science instruction. *(e.g. to share ideas and experiences)*

☐ Frequently *(more than once a week)*	55
☐ Often *(more than once a month)*	87
☐ Sometimes *(more than once every 3 months)*	29
☐ Rarely *(more than once a year)*	5
☐ Not at all	2

t1Q28a t1Q28 OK

Is this something that has changed since your district got involved in BaySci?[7]

- ☐ Yes, this has changed for the better.
- ☐ Yes, this has changed for the worse.
- ☐ No, there has not been a change.

- [ ] Not sure.

t1Q28b_x t1Q28a OK

Comments:

63

Please indicate how much you agree or disagree with the following statements based on the current status at your school:

t1Q29 BaySci District Strand participants

There are shared expectations and a common vision among staff concerr science instruction.

☐	Strongly Agree	15
☐	Agree	73
☐	Undecided	30
☐	Disagree	52
☐	Strongly Disagree	5

t1Q29a t1Q29 OK

Is this something that has changed since your district got involved in BaySci?

- [ ] Yes, this has changed for the better.

- ☐ Yes, this has changed for the worse.
- ☐ No, there has not been a change.
- ☐ Not sure.

t1Q29a_x t1Q29a OK

Comments:

51

t1Q30 BaySci District Strand participants

There are enough pedagogical materials (e.g. textbooks, other media) available to meet my needs for science.

☐ Strongly Agree	30
☐ Agree	82
☐ Undecided	26
☐ Disagree	32
☐ Strongly Disagree	6

t1Q30a t1Q30 OK

Is this something that has changed since your district got involved in BaySci?

☐ Yes	17
☐ No	74
☐ Not sure	27

t1Q30a_x t1Q30a OK

Comments:

45

t1Q31 BaySci District Strand participants

There are enough other science materials (e.g. well-stocked kits) available for class and lab activities.

☐	Strongly Agree	52
☐	Agree	79
☐	Undecided	12
☐	Disagree	27
☐	Strongly Disagree	6

t1Q31a t1Q31 OK

Is this something that has changed since your district got involved in BaySci?

- ☐ Yes, this has changed for the better.
- ☐ Yes, this has changed for the worse.
- ☐ No, there has not been a change.
- ☐ Not sure.

t1Q31a_x t1Q31a OK

Comments:

39

t1Q32 BaySci District Strand participants

There is a clear channel for communicating my science education needs in my school or district.

- ☐ Strongly Agree 27
- ☐ Agree 71
- ☐ Undecided 41
- ☐ Disagree 26
- ☐ Strongly Disagree 10

t1Q32a t1Q32 OK

Is this something that has changed since your district got involved in BaySci?

- ☐ Yes, this has changed for the better.
- ☐ Yes, this has changed for the worse.
- ☐ No, there has not been a change.
- ☐ Not sure.

t1Q32a_x t1Q32a OK

Comments:

40

t1Q33 BaySci District Strand participants

There is support available from my school or district for addressing any challenges I face in science instruction.

- ☐ Strongly Agree 31
- ☐ Agree 74
- ☐ Undecided 36
- ☐ Disagree 36
- ☐ Strongly Disagree 7

t1Q33a t1Q33 OK

Is this something that has changed since your district got involved in BaySci?

- ☐ Yes, this has changed for the better.
- ☐ Yes, this has changed for the worse.
- ☐ No, there has not been a change.
- ☐ Not sure.

t1Q33a_x t1Q33a OK

Comments:

36

Please indicate how much you agree or disagree with the following statements based on the current status at your school and/or district:

t1T40 Q4=1 and BaySci District Strand participants OR Q4=2 and BaySci District Strand participants

The importance of including science curriculum has been clearly communicated to all teachers by school leadership.

☐ Strongly Agree	24
☐ Agree	59
☐ Undecided	20
☐ Disagree	37
☐ Strongly Disagree	8

t1T40a t1T40 OK

Is this something that has changed since your district got involved in BaySci?

- ☐ Yes, this has changed for the better.
- ☐ Yes, this has changed for the worse.
- ☐ No, there has not been a change.
- ☐ Not sure

t1T40a_x t1T40a OK

Comments:

26

t1T41 Q4=1 and BaySci District Strand participants OR Q4=2 and BaySci District Strand participants

The school supports teachers in participating in professional development activities.

☐ Strongly Agree	47
☐ Agree	74
☐ Undecided	15
☐ Disagree	10
☐ Strongly Disagree	4

t1T41a t1T41 OK

Is this something that has changed since your district got involved in BaySci?

- Yes, this has changed for the better.
- Yes, this has changed for the worse.
- No, there has not been a change.
- Not sure.

t1T41a_x t1T41a OK

Comments:

20

t1T42 Q4=1 and BaySci District Strand participants OR Q4=2 and BaySci District Strand participants

The district supports teachers in participating in professional development activities related to science.

- ☐ Strongly Agree 38
- ☐ Agree 74
- ☐ Undecided 17
- ☐ Disagree 17
- ☐ Strongly Disagree 2

t1T42a t1T42 OK

Is this something that has changed since your district got involved in BaySci?

- ☐ Yes, this has changed for the better.
- ☐ Yes, this has changed for the worse.
- ☐ No, there has not been a change.
- ☐ Not sure

t1T42a_x t1T42a OK

Comments:

23

t1T43 Q4=1 and BaySci District Strand participants OR Q4=2 and BaySci District Strand participants

Teachers know where to get their technical or pedagogical questions answered for science instruction in the classroom.

- ☐ Strongly Agree 12
- ☐ Agree 53

- ☐ Undecided 46
- ☐ Disagree 26
- ☐ Strongly Disagree 10

t1T43a t1T43 OK

Is this something that has changed since your district got involved in BaySci?

- ☐ Yes, this has changed for the better.
- ☐ Yes, this has changed for the worse.
- ☐ No, there has not been a change.
- ☐ Not sure.

t1T43a_x t1T43a OK

Comments:

20

t1T44 Q4=1 and BaySci District Strand participants OR Q4=2 and BaySci District Strand participants

Teachers consider me a resource to address their technical or pedagogical needs for science instruction.

- ☐ Strongly Agree 25
- ☐ Agree 59
- ☐ Undecided 42
- ☐ Disagree 20
- ☐ Strongly Disagree 1

t1T44a t1T44 OK

Is this something that has changed since your district got involved in BaySci?

- ☐ Yes, this has changed for the better.
- ☐ Yes, this has changed for the worse.
- ☐ No, there has not been a change.
- ☐ Not sure.

t1T44a_x t1T44a OK

Comments:

24

t1T45 Q4=1 and BaySci District Strand participants OR Q4=2 and BaySci District Strand participants

My school has made policies that facilitate science instruction in the classroom.

☐ Strongly Agree	19
☐ Agree	43
☐ Undecided	41
☐ Disagree	33
☐ Strongly Disagree	12

t1T45a t1T45 OK

Is this something that has changed since your district got involved in BaySci?

- ☐ Yes, this has changed for the better.
- ☐ Yes, this has changed for the worse.
- ☐ No, there has not been a change.
- ☐ Not sure.

t1T45a_x t1T45a OK

Comments:

17

t1T46 Q4=1 and BaySci District Strand participants OR Q4=2 and BaySci District Strand participants

My district has made policies that facilitate science instruction in the classroom.

☐ Strongly Agree	20
☐ Agree	48
☐ Undecided	36
☐ Disagree	34
☐ Strongly Disagree	10

t1T46a t1T46 OK

Is this something that has changed since your district got involved in BaySci?

- ☐ Yes, this has changed for the better.

- ☐ Yes, this has changed for the worse.
- ☐ Yes, this has changed for the worse.
- ☐ Not sure.

t1T46a_x t1T46a OK

Comments:

27

Part VI. BaySci Forum Evaluation

F1 **Did you attend the BaySci forum event at the Exploratorium in San Francisco on September 30, 2013?**

☐ Yes	30
☐ No	149

F2 F1=1

How would you rate the overall quality of the Forum?

☐ Very poor quality	0
☐ Poor quality	0
☐ Mixed quality	2
☐ Good quality	19
☐ Excellent quality	9

F2_x F1=1

Comments:

7

F3 F1=1

How would you rate the usefulness of the Forum to you?

☐ Not useful	0
☐ Of little use	1
☐ Of some use	10
☐ Of considerable use	12
☐ Of great use	7

F3_x F1=1

Comments:

9

F4 F1=1

Would you attend future BaySci forum events?

☐ Yes	26
☐ No	0
☐ Depends on the topic	4

F5 F1=1

To what extent do you agree or disagree with each of the following statements? *(Select one box in each row.)*

	Disagree strongly	Disagree	Agree somewhat	Agree	Agree strongly	Don't know
a. The forum supports those working to improve elementary science education in the Bay Area and helps keep the focus on science	0	0	1	12	17	0
b. The forum increased my understanding about ways to support the improvement of elementary science.	0	0	7	13	10	0
c. The forum advanced my own interest and commitment to improve elementary science education.	0	2	1	14	13	0
d. The forum increased my awareness of and/or understanding of the Next Generation Science Standards.	0	2	9	8	11	0

e. The forum increased my awareness and/or understanding of the role of student discourse in science.	0	1	4	11	13	1
f. The forum furthered my understanding about classroom and district-level implementation of the CCSS and NGSS.	0	3	5	14	8	0
g. The forum provided an opportunity for me to network and connect with colleagues.	0	0	3	12	15	0
h. The forum gave me an opportunity to talk with others engaged in the improvement of elementary science education.	0	0	2	10	18	0

F6_x F1=1

Please provide any comments on the forum here. *(e.g. feedback on the Sept. 30 event, topics you would be interested in for the future, or reasons you may not return.)*

23

Consent = no

Thank you for your consideration.

Click "Submit" to close your survey and receive no further messages about it (window will close)

Consent = yes

Thank you for your participation!

Click "Submit" to save your responses (window will close)

Appendix B. In-district Analysis Summaries (April 2014)

Cross-district Overview Data

To facilitate the work at Lawrence Hall of Science (LHS) in preparation for district meetings, some cross-district data is provided in this section.

Table 1 (below) summarizes the survey data concerning the number of lessons per typical week and minutes per typical lesson that teachers reported offering in the surveys. Teachers who reported a change in the amount of science they offered before BaySci also were asked to provide the frequency and duration of their science lessons before BaySci.

Table 1. Change in science instruction frequency and duration as reported by teachers[8]. Source: BaySci 2013 Survey[9]

	Champions	Alameda	Newark	Oakland	Orinda	Petaluma	Santa Clara	TOTAL
No. of teacher respondents (for items below)	64	15	15	11	10	15	11	148[10]
Total number of respondents	65	19	18	20	17	18	14	181
At the time of completing survey								
Average frequency of science lessons weekly	3.41	2.83	3.01	2.64	3.20	3.29	3.20	**3.19**
Average duration of science lessons (minutes)	49.8	48.7	41.7	60.0	48.0	70.4	48.5	**51.4**
Average of individual teacher's weekly minutes	169.3	126.7	130.9	157.7	156.0	217.1	139.5	**160.8**
Change reported since joining BaySci[11]								
Change in frequency	-0.09	-0.23	0.43	-0.27	-0.30	0.20	-0.30	**-0.11**
Change in duration (in minutes)	4.5	0.3	4.0	2.3	6.0	8.9	5.0	**4.5**
Change in weekly minutes (frequency x duration)	12.5	-9.5	26.0	-14.1	2.0	38.2	9.0	**9.7**

[8] Note that table numbering in this document starts with 1 for each district's section. This is to facilitate splitting the document into several separate documents. Each section is intended to stand alone.

[9] Table numbering in this appendix does not continue from the main document because each of the summaries is designed for possible distribution to relevant district staff.

[10] Note that some Champions strand participants also work in districts that are part of the district strand. These teachers are counted in multiple columns. We also include district strand participants from districts no longer participating in BaySci in this count.

[11] Calculated by subtracting the pre-BaySci values from the present values, positive numbers indicate increase.

Note that averages shown in table 1 include teachers who responded that there was no change to the amount of science they teach since they joined BaySci. These teachers are considered to have zero change in duration and frequency.[12]

BaySci participants are reporting that **they spend more time teaching science** but **the increase they report comes entirely from increases in lesson duration**. The number of times teachers offer science each week went down overall (by .11 lessons per week).

The data also reinforce the idea that **science reform takes time**. The two districts that have participated in BaySci the longest, Newark and Petaluma, are the districts showing the largest increases in time that respondents report spending on science instruction. They are also the only two districts showing an increase in both the duration and frequency of science lessons.

Teachers in two districts, Alameda and Oakland, reported reductions in the amount of time they spend teaching science. Several individual teachers in these districts reported large decreases in the frequency of science instruction (from 4-5 times per week to 1-2 times per week). In these districts, there are teachers offering more frequent science instruction but their increases are more than balanced by the large decreases reported by their peers.

We caution against comparing the numbers of minutes of science instruction reported by teachers across districts or interpreting these numbers to reflect directly on the amount of science offered to students. In some districts teachers reported that team teaching was common with a single teacher in a cohort offering all of the science instruction in a grade level. In other districts, every teacher taught science to their own students only. Much of the variation in weekly minutes of science instruction teachers offer may be related to differences in how much the responsibility for science instruction is distributed among teachers.

Reduced versions of table 1 showing data on individual districts are included in each of the district summary documents that follow.

Cross district classroom observation data

Below we provide capsule ratings to date from classroom observations. These data are not suitable for sharing with districts in their current form. There are several options for summarizing this information to protect the anonymity of the teachers observed and provide a thumbnail sketch of ratings. We could adapt these data to an interval scale, weighing the difference between "3 low" and "3 medium" to be the same as the difference between 4 and 5.

[12] In the past, we have reported average change only for teachers who did report a difference.

This would allow averaging of scores. There are compromises with this approach, observers would likely agree that the distance between a 1 and a 2, for example, is greater than some of the other intervals.

We also recommend against comparing these ratings across districts. In the observers often specialized in particular districts so any issues with inter-rater reliability could be conflated with district variation.

Table 2. Observer capsule ratings to date. Source: observations through 04/01/14
Note that ratings should not be shared in this raw form with individual districts.

	Observer Capsule Ratings	
	2012-2013 school year	**2013-2014 school year**
Alameda	3 med, 3 med, 3 med, 3 low , 1	4, 4, 1
Newark	3 high, 3 med, 1	BLANK
Oakland	Not observed 2012-2013	BLANK
Orinda	Not observed 2012-2013	BLANK
Petaluma	3 med, 3 med, 3 med, 3 low, 1	BLANK
Santa Clara	BLANK	5, 5, 5
Champions	4, 4, 4, 3 high, 3 med, 3 low	5, 5, 5, 3, 2

Capsule rating key:

- BLANK: Left blank to ensure anonymity (2 or fewer observations complete)
- Level 1: Ineffective Instruction
- Level 2: Elements of Effective Instruction
- Level 3 low: Beginning Stages of Effective Instruction
- Level 3 med.: Beginning Stages of Effective Instruction
- Level 3 high: Beginning Stages of Effective Instruction
- Level 4: Accomplished, Effective Instruction
- Level 5: Exemplary Instruction.

Table Interpretation

In each of the district overviews (below), we provide tables describing how frequently teachers ask students to engage with the NGSS science and engineering practices and how frequently they assign certain activities that involve ELA. In the tables, we provide short headings for readability. The full text of the response choices provided in the survey are listed below. This information may be useful in helping district representatives understand the data presented in their overviews. Note that frequency is considered here relative to the total amount of science the teacher offers (i.e. as a percentage of science lessons)

- Never / almost never (in fewer than 10% of science lessons)
- Rarely (in 10-30% of science lessons)
- Sometimes (in 30-60% of science lessons)
- Often (in 60-90% of science lessons)
- Always (in 90% or more of the lessons)

Alameda Unified School District

Overview of data collected through observations of classrooms taught by BaySci participants, BaySci participant interviews, and BaySci participant surveys.

Science Instruction

We interviewed seven Alameda teachers and one administrator who participate in BaySci. Interviewees reported two major changes to science instruction in their classrooms or schools that they attributed to the district participating in BaySci.

1. Most interviewees reported that the main result of the district participating in BaySci is that teachers are offering more science in their classrooms than before. In one example, a teacher told us "I came into BaySci this year wanting to do every investigation in the FOSS kit."
2. Teachers report that they are using notebooks more in their classroom leading to more nonfiction writing. Two teachers pointed out that there is also a district push for more notebook use, meaning they believe that BaySci is not the only factor in this increase[13]. BaySci does, however, help guide teachers on how to best implement notebook use. In the words of one teacher: "They tell us how to use notebooks - not making corrections, editing, that's hard for a lot of us teachers. It's hard for teachers but also liberating. I think that's also why kids are writing more.. it's not stressful"

Two teachers also mentioned that they now start every science lesson with focus questions and attribute this to their BaySci experience.

Teachers participating in the survey reported on how often they teach science and how long their typical science lesson lasts. Teachers also indicated if there was any difference between how much science instruction they offer now and before participating in BaySci.

[13] We believe that the additional efforts to promote notebook use may be the result of the BaySci work with district leadership. It may be that teachers don't recognize this as being associated with BaySci.

Table 1. Change in science instruction frequency and duration as reported by Alameda teachers. Source: BaySci survey, N=15 teachers.

At the time of completing survey	Average frequency of science lessons weekly	2.83
	Average duration of science lessons (in minutes)	48.7
	Average of individual teacher's weekly minutes	126.7
Change Since joining BaySci[14]	Change in frequency	-0.23
	Change in duration (in minutes)	0.3
	Change in weekly minutes (frequency x duration)	-9.5

Alameda teachers participating in BaySci report offering less science now than before participating in BaySci. This result is difficult to reconcile with the fact that in interviews, teachers report more frequent science offerings. Note that in contrast to the survey questions in which teachers were asked to report on their own teaching, in interview data, teachers reported on what they sensed was happening across the district.

We asked teachers how often they ask students to carry out each of the science and engineering practices from the Next Generation Science Standards (NGSS). We also asked whether teachers noted any change in how often they asked their students to engage with the practices since participating in BaySci. Table 3 (below) summarizes teacher responses to these questions. The table shows that teachers in Alameda reported frequent enactments of NGSS practices in classrooms and increases in incorporating almost all of the practices in their instruction (the exception was using mathematics and computational thinking).

[14] Calculated by subtracting the pre-BaySci values from the present values, positive numbers indicate increase

Table 2. Teacher report on how frequently they ask students to carry out science and engineering practices. Source: 2013 BaySci survey.

NGSS Science and Engineering Practices	**How often do teachers report asking students to carry out NGSS practices?**[15]					**More often since starting BaySci?**
	Never / almost never (<10%)	**Rarely** (10-30%)	**Some-times** (30-60%)	**Often** (60-90%)	**Always** (>90%)	
Asking questions and/or defining problems	0%	0%	13%	73%	13%	73%
Developing and using models	0%	27%	40%	20%	13%	45%
Planning and carrying out investigations	0%	7%	20%	53%	20%	73%
Analyzing and interpreting data	7%	0%	40%	27%	27%	55%
Using mathematics and computational thinking	7%	13%	60%	7%	13%	36%
Constructing explanations and/or designing solutions	7%	13%	20%	40%	20%	73%
Engaging in argument from evidence	7%	7%	40%	40%	7%	73%
Obtaining, evaluating, and communicating information	0%	0%	27%	60%	13%	64%

In a similar set of questions, we asked teachers how often they asked students to engage in activities that link science with language arts. Table 4 (below) summarizes teacher responses to these questions. This table shows that teachers report integrating science with language arts more since joining BaySci and that they employ a wide range of strategies to do so.

[15] Percentages refer to the percent of science lessons offered.

Table 3. Teacher report on how frequently they ask students to engage in activities that link science with language arts. Source: 2013 BaySci survey.

Activities that link science with language arts	How often do teachers report asking students to carry out NGSS practices?[16]					More often since starting BaySci?
	Never / almost never (<10%)	Rarely (10-30%)	Some-times (30-60%)	Often (60-90%)	Always (>90%)	
Working in science notebooks	0%	7%	27%	27%	40%	91%
Writing science reflections	0%	0%	33%	53%	13%	91%
Extended science reading	7%	13%	53%	27%	0%	55%
Other assignments that link science and language arts	7%	0%	33%	47%	0%	45%

Leadership and Culture

Interview respondents had varying opinions and feedback about leadership and support and accountability for science teaching in their schools.

Several interviewees commented that science instruction is increasing:

- "This year it's like science is back at our school. We adopted FOSS 5-6 years ago [...] they gave us the materials with very little PD or support to replace materials. But now the district is pushing for BaySci participation plus the pressure for Common Core standards are so sciency."
- One teacher reported having a principal who is supportive of science instruction and who participated in the BaySci leadership team. This teacher believed that the district is getting swept up in science and "jumping on the bandwagon."

1.

Several respondents commented on the presence or absence of accountability for teaching science in Alameda:

- Two teachers claimed that there was not much accountability for science in their schools, reporting that teachers could choose not to offer science without difficulty.

[16] Percentages refer to the percent of science lessons offered.

- One other respondent noted a contradicting opinion, that unlike before BaySci when there was no requirement for science instruction, the new science notebooking expectation means that all teachers must offer science.
- One respondent claimed that there is a limit on how much the district can push for increased science in classrooms. Teachers may demand more prep time if asked to teach more science.

We asked survey respondents to rate their agreement with several statements related to district leadership and culture. Respondents had five options ranging from “strongly agree” to “strongly disagree”. We also asked respondents if they thought these aspects of leadership and culture had changed for the worse, for the better, or shown no change since the district started participating in BaySci. Table 4 (below) shows the percentage of teachers who selected “agree” or “agree strongly” for each of the statements and the percentage reporting change for the better since BaySci.

Table 4. Level of agreement and change ratings related to several dimensions of leadership and culture. Source: BaySci 2014 participant survey.

Statement	Level of agreement: "Strongly agree" or "agree"	Change since BaySci? "for the better"
The importance of including science curriculum has been clearly communicated to all teachers by school leadership.	62%	46%
The school supports teachers in participating in professional development activities.	85%	38%
The district supports teachers in participating in professional development activities related to science.	77%	46%
Teachers know where to get their technical or pedagogical questions answered for science instruction in the classroom.[17]	31%	23%
Teachers consider me a resource to address their technical or pedagogical needs for science instruction.	54%	23%
My school has made policies that facilitate science instruction in the classroom.	38%	31%
My district has made policies that facilitate science instruction in the classroom.	46%	46%[18]

Overall, respondents in Alameda report high levels of support for professional development noting increases in support at the school and district level since the district started participating in BaySci. Fewer teachers reported that the district had reached a high level in terms of providing access to expertise (answering questions) and policies at the school that support science.

[17] 15% of respondents chose "disagree strongly" and 38% were undecided or did not respond to the question about change since BaySci.

[18] 54% chose not sure or left blank the question about change since BaySci.

Teacher Leadership Academy and Master Group Seminar Participant Surveys (Inverness Research)

In February 2014, Inverness Research surveyed Teacher Leadership Academy and Master Group Seminar participants. From the 56 completed surveys, common findings emerged across all districts. We have organized these into two categories – Usefulness of BaySci Offerings and Awareness of and Connection to District Efforts to Improve Elementary Science.

Usefulness of BaySci Offerings

- A large majority of participants reports that the BaySci Teacher Leadership Academy and Master Group Seminar offerings are extremely or very useful in terms of furthering their own professional learning and improving their elementary science instruction.
- Based on their participation in BaySci, about half of the respondents feel extremely or very empowered or encouraged to take on leadership roles related to elementary science teaching in their schools and districts.
- More than half indicated that they would like BaySci to provide more leadership training and support in taking on leadership roles in elementary science teaching.

Connection to District Efforts to Improve Elementary Science

- About 2/3 of the teachers are aware of their of their district's vision statement.
- Slightly less than 2/3 are aware of their district's plans to improve elementary science education.
- We received a wide range of responses to the question: To what extent do you feel connected to the overall effort to improve science education in your district? These vary from feeling extremely and very connected to somewhat connected, to slightly or not at all connected.
- Almost 70% of teachers report that it's not clear to them how the district wants to use teacher leaders, like the TLA and MGS participants, to accomplish its plans for elementary science.

Newark Unified School District

Overview of data collected through observations of classrooms taught by BaySci participants, BaySci participant interviews, and BaySci participant surveys.

Science Instruction

There were few common themes concerning how teacher interviewees from Newark reported changes to their instruction since joining BaySci. Two respondents reported more integration between science and ELA while another reported more engagement with some of the NGSS practices.

Several teachers who were interviewed and observed were involved in team teaching arrangements in which a single teacher handled all of the science instruction for a full grade level in a school. Those who taught science generally opted to specialize in science and had participated in science professional development at different times. FOSS was in use in all classrooms observed but not exclusively. One 6th grade teacher reported limited FOSS resources available at the higher grade level.

In some cases, we learned that classroom teachers and science specialists communicate regularly to integrate the work they do in science. One science specialists reported being unsure about whether all classroom teachers carried out activities to complement the time in the science labs.

Teachers participating in the survey reported on how often they teach science and how long their typical science lesson lasts. Teachers also indicated if there was any difference between how much science instruction they offer now and before participating in BaySci. Newark teachers reported teaching science more often and for longer periods of time resulting in an increase of 26 minutes per week for the average teacher.

Table 1. Change in science instruction frequency and duration as reported by Newark teachers. Source: BaySci survey, N=15 teachers.

At the time of completing survey	Average frequency of science lessons weekly	3.01
	Average duration of science lessons (in minutes)	41.7
	Average of individual teacher's weekly minutes	130.9
Change Since joining BaySci[19]	Change in frequency	0.43
	Change in duration (in minutes)	4.0
	Change in weekly minutes (frequency x duration)	26.0

We asked teachers how often they ask students to carry out each of the science and engineering practices from the Next Generation Science Standards (NGSS). We also asked whether teachers noted any change in how often they asked their students to engage with the practices since participating in BaySci. Table 3 (below) summarizes teacher responses to these questions. Teachers report regularly asking students to engage with NGSS practices. A large number of teachers asks students to engage in questioning "sometimes" or "often".

[19] Calculated by subtracting the pre-BaySci values from the present values, positive numbers indicate increase

Table 2. Teacher report on how frequently they ask students to carry out science and engineering practices. Source: 2013 BaySci survey.

NGSS Science and Engineering Practices	How often do teachers report asking students to carry out NGSS practices?[20]					More often since starting BaySci?
	Never / almost never (<10%)	Rarely (10-30%)	Some-times (30-60%)	Often (60-90%)	Always (>90%)	
Asking questions and/or defining problems	0%	5%	47%	37%	0%	67%
Developing and using models	0%	21%	42%	26%	0%	47%
Planning and carrying out investigations	0%	21%	32%	37%	0%	40%
Analyzing and interpreting data	5%	16%	47%	16%	5%	60%
Using mathematics and computational thinking	5%	42%	26%	11%	5%	33%
Constructing explanations and/or designing solutions	0%	11%	47%	21%	5%	60%
Engaging in argument from evidence	5%	37%	26%	11%	5%	47%
Obtaining, evaluating, and communicating information	5%	16%	37%	21%	11%	73%

In a similar set of questions, we asked teachers how often they asked students to engage in activities that link science with language arts. Table 4 (below) summarizes teacher responses to these questions. Teachers reported assigning all activity types regularly with almost 80% using science notebooks. Many teachers reported that they ask students to write science reflections more now than before joining BaySci.

Table 3. Teacher report on how frequently they ask students to engage in activities that link science with language arts. Source: 2013 BaySci survey.

[20] Percentages refer to the percent of science lessons offered.

Activities that link science with language arts	How often do teachers report asking students to carry out NGSS practices?[21]					More often since starting BaySci?
	Never / almost never (<10%)	Rarely (10-30%)	Some-times (30-60%)	Often (60-90%)	Always (>90%)	
Working in science notebooks	5%	11%	16%	58%	5%	44%
Writing science reflections	11%	16%	26%	42%	0%	63%
Extended science reading	0%	37%	26%	26%	0%	31%
Other assignments that link science and language arts	5%	16%	47%	16%	0%	25%

Leadership and Culture

Teachers participating in interviews noted that there has been a lot of change in leadership in Newark in recent years. While several reported that there has been support and interest in science recently, there was a sense of concern about how long the district will continue to focus on science.

Interviewees were appreciative of some of the resources that have been available for science outside of classroom resources. Two teachers noted opportunities for science-related field trips were available, one teacher commented on summer camps and events in which animals are brought to the school. Current leadership was credited for providing district-wide science professional development by two interviewees and one appreciated that FOSS kits are being provided and maintained.

We asked survey respondents to rate their agreement with several statements related to district leadership and culture. Respondents had five options ranging from “strongly agree” to “strongly disagree”. We also asked respondents if they thought these aspects of leadership and culture had changed for the worse, for the better, or shown no change since the district started participating in BaySci. Table 4 (below) shows the percentage of teachers who

[21] Percentages refer to the percent of science lessons offered.

selected “agree” or “agree strongly” for each of the statements and the percentage who report change for the better since BaySci. The table suggests that the internal messaging around science has not been strong with only 38% of teachers agreeing or strongly agreeing with the statement “The importance of including science curriculum has been clearly communicated to all teachers by school leadership.” Teachers gave higher agreement ratings to positive statements about access to professional development and getting questions answered.

Table 4. Level of agreement and change ratings related to several dimensions of leadership and culture. Source: BaySci 2014 participant survey.

Statement	Level of agreement: "Strongly agree" or "agree"	Change since BaySci? "for the better"[22]
The importance of including science curriculum has been clearly communicated to all teachers by school leadership.	38%	25%
The school supports teachers in participating in professional development activities.	69%	31%
The district supports teachers in participating in professional development activities related to science.	75%	38%
Teachers know where to get their technical or pedagogical questions answered for science instruction in the classroom.	63%	25%
Teachers consider me a resource to address their technical or pedagogical needs for science instruction.	25%	13%
My school has made policies that facilitate science instruction in the classroom.[23]	38%	19%
My district has made policies that facilitate science instruction in the classroom. [24]	50%	31%

Teacher Leadership Academy and Master Group Seminar Participant Surveys (Inverness Research)

In February 2014, Inverness Research surveyed Teacher Leadership Academy and Master Group Seminar participants. From the 56 completed surveys, common findings emerged

[22] A large number of Newark respondents (51% across all statements) left the items about change blank or selected "not sure".

[23] 13% selected "disagree strongly" for this statement.

[24] 13% selected "disagree strongly" for this statement.

across all districts. We have organized these into two categories – Usefulness of BaySci Offerings and Awareness of and Connection to District Efforts to Improve Elementary Science.

Usefulness of BaySci Offerings

- A large majority of participants reports that the BaySci Teacher Leadership Academy and Master Group Seminar offerings are extremely or very useful in terms of furthering their own professional learning and improving their elementary science instruction.
- Based on their participation in BaySci, about half of the respondents feel extremely or very empowered or encouraged to take on leadership roles related to elementary science teaching in their schools and districts.
- More than half indicated that they would like BaySci to provide more leadership training and support in taking on leadership roles in elementary science teaching.

Connection to District Efforts to Improve Elementary Science

- About 2/3 of the teachers are aware of their of their district's vision statement.
- Slightly less than 2/3 are aware of their district's plans to improve elementary science education.
- We received a wide range of responses to the question: To what extent do you feel connected to the overall effort to improve science education in your district? These vary from feeling extremely and very connected to somewhat connected, to slightly or not at all connected.
- Almost 70% of teachers report that it's not clear to them how the district wants to use teacher leaders, like the TLA and MGS participants, to accomplish its plans for elementary science.

Oakland Unified School District

Overview of data collected through observations of classrooms taught by BaySci participants, BaySci participant interviews, and BaySci participant surveys.

Science Instruction

Teachers participating in the survey reported on how often they teach science and how long their typical science lesson lasts. Teachers also indicated if there was any difference between how much science instruction they offer now and before participating in BaySci.

Oakland teachers reported an overall decrease in science instruction resulting from fewer science lessons despite a reported an increase in the average length of a lesson.

Table 1. Change in science instruction frequency and duration as reported by Oakland teachers. Source: BaySci survey, N=11 teachers.

At the time of completing survey	Average frequency of science lessons weekly	2.64
	Average duration of science lessons (in minutes)	60.0
	Average of individual teacher's weekly minutes	157.7
Change Since joining BaySci[25]	Change in frequency	-0.27
	Change in duration (in minutes)	2.3
	Change in weekly minutes (frequency x duration)	-14.1

We asked teachers how often they ask students to carry out each of the science and engineering practices from the Next Generation Science Standards (NGSS). We also asked whether teachers noted any change in how often they asked their students to engage with the practices since participating in BaySci. Table 3 (below) summarizes teacher responses to these questions. Teachers reported that they frequently ask students to engage in the NGSS science and engineering practices and many reported that they ask students to engage with the practices more frequently since participating in BaySci.[26] 70% of teachers reported asking

[25] Calculated by subtracting the pre-BaySci values from the present values, positive numbers indicate increase

[26] The majority of those who did not choose "more frequently" selected "no change". Only one teacher selected "less frequently" for a single practice; Using mathematics and computational thinking.

students to engaging in argument from evidence and obtain, evaluate, and communicate information more frequently since starting BaySci.

Table 2. Teacher report on how frequently they ask students to carry out science and engineering practices. Source: 2013 BaySci survey.

NGSS Science and Engineering Practices	**How often do teachers report asking students to carry out NGSS practices?**[27]					**More often since starting BaySci?**
	Never / almost never (<10%)	**Rarely** (10-30%)	**Some-times** (30-60%)	**Often** (60-90%)	**Always** (>90%)	
Asking questions and/or defining problems	0%	0%	36%	43%	14%	40%
Developing and using models	7%	36%	29%	21%	0%	40%
Planning and carrying out investigations	0%	14%	43%	29%	7%	40%
Analyzing and interpreting data	7%	14%	57%	7%	7%	50%
Using mathematics and computational thinking	29%	29%	21%	14%	0%	30%
Constructing explanations and/or designing solutions	7%	14%	36%	29%	7%	50%
Engaging in argument from evidence	7%	36%	29%	21%	0%	40%
Obtaining, evaluating, and communicating information	0%	21%	7%	43%	21%	40%

In a similar set of questions, we asked teachers how often they asked students to engage in activities that link science with language arts. Table 4 (below) summarizes teacher responses to these questions. All teachers reported using science notebooks with 60% reporting that they use them more frequently since BaySci. Almost all (95%) teachers also reported assigning written science reflections.

[27] Percentages refer to the percent of science lessons offered.

Table 3. Teacher report on how frequently they ask students to engage in activities that link science with language arts. Source: 2013 BaySci survey.

Activities that link science with language arts	How often do teachers report asking students to carry out NGSS practices?[28]					More often since starting BaySci?
	Never / almost never (<10%)	**Rarely** (10-30%)	**Some-times** (30-60%)	**Often** (60-90%)	**Always** (>90%)	
Working in science notebooks	0%	7%	14%	43%	36%	60%
Writing science reflections	0%	43%	14%	36%	7%	50%
Extended science reading	14%	21%	29%	36%	0%	40%
Other assignments that link science and language arts	0%	21%	50%	0%	7%	30%

Leadership and Culture

We asked survey respondents (all BaySci participants) to rate their agreement with several statements related to district leadership and culture. Respondents had five options ranging from "strongly agree" to "strongly disagree". We also asked respondents if they thought these aspects of leadership and culture had changed for the worse, for the better, or shown no change since the district started participating in BaySci. Table 4 (below) shows the percentage of teachers who selected "agree" or "agree strongly" for each of the statements and the percentage who report change for the better since BaySci.

[28] Percentages refer to the percent of science lessons offered.

Table 4. Level of agreement and change ratings related to several dimensions of leadership and culture. Source: BaySci 2014 participant survey.

Statement	Level of agreement: "Strongly agree" or "agree"	Change since BaySci? "for the better"[29]
The importance of including science curriculum has been clearly communicated to all teachers by school leadership.	80%	10%
The school supports teachers in participating in professional development activities.	80%	10%
The district supports teachers in participating in professional development activities related to science.	90%	
Teachers know where to get their technical or pedagogical questions answered for science instruction in the classroom.	50%	10%
Teachers consider me a resource to address their technical or pedagogical needs for science instruction.	70%	10%
My school has made policies that facilitate science instruction in the classroom.	50%	10%
My district has made policies that facilitate science instruction in the classroom.	80%	20%

[29] A large number of Oakland respondents (53% across all statements) left the items about change blank or selected "not sure".

Teacher Leadership Academy and Master Group Seminar Participant Surveys (Inverness Research)

In February 2014, Inverness Research surveyed Teacher Leadership Academy and Master Group Seminar participants. From the 56 completed surveys, common findings emerged across all districts. We have organized these into two categories – Usefulness of BaySci Offerings and Awareness of and Connection to District Efforts to Improve Elementary Science.

Usefulness of BaySci Offerings

- A large majority of participants reports that the BaySci Teacher Leadership Academy and Master Group Seminar offerings are extremely or very useful in terms of furthering their own professional learning and improving their elementary science instruction.
- Based on their participation in BaySci, about half of the respondents feel extremely or very empowered or encouraged to take on leadership roles related to elementary science teaching in their schools and districts.
- More than half indicated that they would like BaySci to provide more leadership training and support in taking on leadership roles in elementary science teaching.

Connection to District Efforts to Improve Elementary Science

- About 2/3 of the teachers are aware of their of their district's vision statement.
- Slightly less than 2/3 are aware of their district's plans to improve elementary science education.
- We received a wide range of responses to the question: To what extent do you feel connected to the overall effort to improve science education in your district? These vary from feeling extremely and very connected to somewhat connected, to slightly or not at all connected.
- Almost 70% of teachers report that it's not clear to them how the district wants to use teacher leaders, like the TLA and MGS participants, to accomplish its plans for elementary science.

Orinda Union School District

Overview of data collected through observations of classrooms taught by BaySci participants, BaySci participant interviews, and BaySci participant surveys.

Science Instruction

Teachers participating in the survey reported on how often they teach science and how long their typical science lesson lasts. Teachers also indicated if there was any difference between how much science instruction they offer now and before participating in BaySci. Overall Orinda teachers report a small increase in the duration or their science lessons while decreasing the frequency of lessons. The result of this is that the average number of minutes per week increased only slightly.

Table 1. Change in science instruction frequency and duration as reported by Orinda teachers. Source: BaySci survey, N=10 teachers.

At the time of completing survey	Average frequency of science lessons weekly	3.20
	Average duration of science lessons (in minutes)	48.0
	Average of individual teacher's weekly minutes	156.0
Change Since joining BaySci[30]	Change in frequency	-0.30
	Change in duration (in minutes)	6.0
	Change in weekly minutes (frequency x duration)	2.0

We asked teachers how often they ask students to carry out each of the science and engineering practices from the Next Generation Science Standards (NGSS). We also asked whether teachers noted any change in how often they asked their students to engage with the practices since participating in BaySci. Table 3 (below) summarizes teacher responses to these questions. Teachers reported asking students to engage with the NGSS practices regularly and for many practices they reported large increases since joining BaySci.

[30] Calculated by subtracting the pre-BaySci values from the present values, positive numbers indicate increase

Table 2. Teacher report on how frequently they ask students to carry out science and engineering practices. Source: 2013 BaySci survey.

NGSS Science and Engineering Practices	How often do teachers report asking students to carry out NGSS practices?[31]					More often since starting BaySci?
	Never / almost never (<10%)	Rarely (10-30%)	Some-times (30-60%)	Often (60-90%)	Always (>90%)	
Asking questions and/or defining problems	0%	9%	27%	55%	9%	100%
Developing and using models	0%	36%	27%	36%	0%	40%
Planning and carrying out investigations	0%	27%	27%	36%	9%	40%
Analyzing and interpreting data	0%	9%	27%	64%	0%	100%
Using mathematics and computational thinking	0%	18%	27%	55%	0%	40%
Constructing explanations and/or designing solutions	0%	18%	36%	36%	9%	60%
Engaging in argument from evidence	0%	27%	27%	45%	0%	100%
Obtaining, evaluating, and communicating information	0%	0%	27%	64%	9%	40%

In a similar set of questions, we asked teachers how often they asked students to engage in activities that link science with language arts. Table 4 (below) summarizes teacher responses to these questions. Over 90% of teachers in Orinda report using science notebooks sometimes, often, or always with teachers reporting unanimously that use of notebooks has increased in their classroom since joining BaySci. Teachers also reported frequent use of written science reflections in their classrooms with increases since BaySci.

[31] Percentages refer to the percent of science lessons offered.

Table 3. Teacher report on how frequently they ask students to engage in activities that link science with language arts. Source: 2013 BaySci survey.

Activities that link science with language arts	How often do teachers report asking students to carry out NGSS practices?[32]					More often since starting BaySci?
	Never / almost never (<10%)	Rarely (10-30%)	Some-times (30-60%)	Often (60-90%)	Always (>90%)	
Working in science notebooks	0%	9%	27%	45%	18%	100%
Writing science reflections	0%	9%	64%	27%	0%	80%
Extended science reading	0%	27%	36%	36%	0%	40%
Other assignments that link science and language arts	9%	9%	9%	36%	0%	0%

Leadership and Culture

We asked survey respondents (all BaySci participants) to rate their agreement with several statements related to district leadership and culture. Respondents had five options ranging from “strongly agree” to “strongly disagree”. We also asked respondents if they thought these aspects of leadership and culture had changed for the worse, for the better, or shown no change since the district started participating in BaySci. Table 4 (below) shows the percentage of teachers who selected “agree” or “agree strongly” for each of the statements and the percentage who report change for the better since BaySci.

In Orinda, teachers report that there are policies in place to facilitate science instruction and that the importance of science has been clearly communicated to all teachers at their school. Teachers reported a lower level of agreement with positive statements about the availability of professional development at the school and district level.

[32] Percentages refer to the percent of science lessons offered.

Table 4. Level of agreement and change ratings related to several dimensions of leadership and culture. Source: BaySci 2014 participant survey.

Statement	Level of agreement: "Strongly agree" or "agree"	Change since BaySci? "for the better"[33]
The importance of including science curriculum has been clearly communicated to all teachers by school leadership.	60%	40%
The school supports teachers in participating in professional development activities.	20%	20%
The district supports teachers in participating in professional development activities related to science.	40%	50%
Teachers know where to get their technical or pedagogical questions answered for science instruction in the classroom.	50%	40%
Teachers consider me a resource to address their technical or pedagogical needs for science instruction.	40%	40%
My school has made policies that facilitate science instruction in the classroom.	60%	50%
My district has made policies that facilitate science instruction in the classroom.	60%	50%

Teacher Leadership Academy and Master Group Seminar Participant Surveys (Inverness Research)

In February 2014, Inverness Research surveyed Teacher Leadership Academy and Master Group Seminar participants. From the 56 completed surveys, common findings emerged across all districts. We have organized these into two categories – Usefulness of BaySci Offerings and Awareness of and Connection to District Efforts to Improve Elementary Science.

Usefulness of BaySci Offerings

[33] A large number of Orinda respondents (58% across all statements) left the items about change blank or selected "not sure".

- A large majority of participants reports that the BaySci Teacher Leadership Academy and Master Group Seminar offerings are extremely or very useful in terms of furthering their own professional learning and improving their elementary science instruction.
- Based on their participation in BaySci, about half of the respondents feel extremely or very empowered or encouraged to take on leadership roles related to elementary science teaching in their schools and districts.
- More than half indicated that they would like BaySci to provide more leadership training and support in taking on leadership roles in elementary science teaching.

Connection to District Efforts to Improve Elementary Science

- About 2/3 of the teachers are aware of their of their district's vision statement.
- Slightly less than 2/3 are aware of their district's plans to improve elementary science education.
- We received a wide range of responses to the question: To what extent do you feel connected to the overall effort to improve science education in your district? These vary from feeling extremely and very connected to somewhat connected, to slightly or not at all connected.
- Almost 70% of teachers report that it's not clear to them how the district wants to use teacher leaders, like the TLA and MGS participants, to accomplish its plans for elementary science.

Petaluma City Schools

Overview of data collected through observations of classrooms taught by BaySci participants, BaySci participant interviews, and BaySci participant surveys.

Science Instruction

We conducted six interviews in Petaluma. Most teachers mentioned that their capacity to integrate science and ELA improved as a result of participating in BaySci. Using science notebooks more often, including BaySci notebook features like an evolving index, glossary, and table of contents, were mentioned as major improvements to their practice. Additionally, teachers reported that they had begun using a “line of learning” to encourage students to use their own language to capture their learning. Lastly, several teachers mentioned that in the past they taught science vocabulary didactically and that since BaySci, they have begun to encourage students to apply new vocabulary in their writing as a means of learning the vocabulary.

Team teaching was widespread but not ubiquitous in Petaluma schools. Three interviewees reported a team teaching approach in their schools but another teacher reported that every teacher in her school teaches science in his or her own classroom. None of the Petaluma schools visited has a school science teacher or a science specialist.

All observed and interviewed teachers use FOSS. Two of the five were not teaching FOSS lessons when observed, but reported that this was somewhat atypical. Generally, teachers reported adapting FOSS lesson plans to increase the integration of ELA content through activities such as reflection writing and science vocabulary writing.

Teachers participating in the survey reported on how often they teach science and how long their typical science lesson lasts. Teachers also indicated if there was any difference between how much science instruction they offer now and before participating in BaySci. Petaluma teachers reported an increase in both the duration and frequency of science lessons resulting in an average of 38 more minutes of science instruction per week per teacher.

Table 1. Change in science instruction frequency and duration as reported by Petaluma teachers. Source: BaySci survey, N=15 teachers.

At the time of completing survey	Average frequency of science lessons weekly	3.29
	Average duration of science lessons (in minutes)	70.4
	Average of individual teacher's weekly minutes	217.1
Change Since joining BaySci[34]	Change in frequency	0.20
	Change in duration (in minutes)	8.9
	Change in weekly minutes (frequency x duration)	38.2

We asked teachers how often they ask students to carry out each of the science and engineering practices from the Next Generation Science Standards (NGSS). We also asked whether teachers noted any change in how often they asked their students to engage with the practices since participating in BaySci. Table 3 (below) summarizes teacher responses to these questions. Most Petaluma teachers reported asking students to engage with science practices regularly.

Table 2. Teacher report on how frequently they ask students to carry out science and engineering practices. Source: 2013 BaySci survey.

NGSS Science and Engineering Practices	**How often do teachers report asking students to carry out NGSS practices?**[35]					**More often since starting BaySci?**
	Never / almost never (<10%)	**Rarely** (10-30%)	**Some-times** (30-60%)	**Often** (60-90%)	**Always** (>90%)	
Asking questions and/or defining problems	0%	11%	22%	56%	11%	56%
Developing and using models	0%	5%	58%	32%	5%	44%
Planning and carrying out investigations	5%	11%	37%	42%	5%	50%

[34] Calculated by subtracting the pre-BaySci values from the present values, positive numbers indicate increase

[35] Percentages refer to the percent of science lessons offered.

Analyzing and interpreting data	0%	11%	42%	37%	11%	69%
Using mathematics and computational thinking	0%	26%	37%	37%	0%	25%
Constructing explanations and/or designing solutions	0%	11%	42%	37%	11%	56%
Engaging in argument from evidence	0%	11%	53%	26%	11%	63%
Obtaining, evaluating, and communicating information	0%	5%	32%	37%	26%	60%

In a similar set of questions, we asked teachers how often they asked students to engage in activities that link science with language arts. Table 4 (below) summarizes teacher responses to these questions. Petaluma teachers reported using all of the activity types named in the question.

Table 3. Teacher report on how frequently they ask students to engage in activities that link science with language arts. Source: 2013 BaySci survey.

Activities that link science with language arts	**How often do teachers report asking students to carry out NGSS practices?**[36]					**More often since starting BaySci?**
	Never / almost never (<10%)	**Rarely** (10-30%)	**Some-times** (30-60%)	**Often** (60-90%)	**Always** (>90%)	
Working in science notebooks	0%	0%	32%	32%	37%	69%
Writing science reflections	0%	5%	47%	26%	21%	75%
Extended science reading	5%	26%	42%	26%	0%	38%
Other assignments that link science and language arts	11%	5%	32%	26%	0%	38%

[36] Percentages refer to the percent of science lessons offered.

Leadership and Culture

Interviewees reported that science has been a lower priority than other subjects for Petaluma City Schools for the past few years. In the recent past, they report that science has not been a focus from teachers outside of the BaySci program. One teacher lamented, "If we weren't participating in BaySci, it [the focus on science] wouldn't exist."

Two interviewees suggested that the tides could be turning for science in Petaluma. They cited the fact that one of the three district-wide PD sessions in the prior school year had been dedicated entirely to science as evidence that the district was starting to prioritize that subject matter more. Furthermore, the decision to hire a half time science specialist for the district also seemed to suggest to some respondents that more science support was on the way.

Three interviewees characterized the leadership of their schools as encouraging and non-rigid. They were expected to teach FOSS, but the amount and the methods were not prescribed or regimented.

We asked survey respondents (all BaySci participants) to rate their agreement with several statements related to district leadership and culture. Respondents had five options ranging from “strongly agree” to “strongly disagree”. We also asked respondents if they thought these aspects of leadership and culture had changed for the worse, for the better, or shown no change since the district started participating in BaySci. Table 4 (below) shows the percentage of teachers who selected “agree” or “agree strongly” for each of the statements and the percentage who report change for the better since BaySci.

Overall, Petaluma respondents reported high levels of agreement with positive statements concerning leadership and culture. The area where respondents gave the weakest ratings related to policies in support of science. In these areas and all others, teachers reported improvement since the district joined BaySci[37]. Consistent with the interview data, table 4 indicates that teachers are encouraged to participate in professional development. Respondents were somewhat less confident in the district polies in support of science.

[37] The remaining teachers almost unanimously reported no change. There were few selections of “changed for the worse” for this item.

Table 4. Level of agreement and change ratings related to several dimensions of leadership and culture. Source: BaySci 2014 participant survey.

Statement	Level of agreement: "Strongly agree" or "agree"	Change since BaySci? "for the better"
The importance of including science curriculum has been clearly communicated to all teachers by school leadership.	65%	47%
The school supports teachers in participating in professional development activities.	88%	24%
The district supports teachers in participating in professional development activities related to science.	88%	47%
Teachers know where to get their technical or pedagogical questions answered for science instruction in the classroom.	65%	29%
Teachers consider me a resource to address their technical or pedagogical needs for science instruction.	35%	24%
My school has made policies that facilitate science instruction in the classroom.	41%	29%
My district has made policies that facilitate science instruction in the classroom.	47%	41%

Teacher Leadership Academy and Master Group Seminar Participant Surveys (Inverness Research)

In February 2014, Inverness Research surveyed Teacher Leadership Academy and Master Group Seminar participants. From the 56 completed surveys, common findings emerged across all districts. We have organized these into two categories – Usefulness of BaySci Offerings and Awareness of and Connection to District Efforts to Improve Elementary Science.

Usefulness of BaySci Offerings

- A large majority of participants reports that the BaySci Teacher Leadership Academy and Master Group Seminar offerings are extremely or very useful in terms of furthering their own professional learning and improving their elementary science instruction.
- Based on their participation in BaySci, about half of the respondents feel extremely or very empowered or encouraged to take on leadership roles related to elementary science teaching in their schools and districts.
- More than half indicated that they would like BaySci to provide more leadership training and support in taking on leadership roles in elementary science teaching.

Connection to District Efforts to Improve Elementary Science

- About 2/3 of the teachers are aware of their of their district's vision statement.
- Slightly less than 2/3 are aware of their district's plans to improve elementary science education.
- We received a wide range of responses to the question: To what extent do you feel connected to the overall effort to improve science education in your district? These vary from feeling extremely and very connected to somewhat connected, to slightly or not at all connected.
- Almost 70% of teachers report that it's not clear to them how the district wants to use teacher leaders, like the TLA and MGS participants, to accomplish its plans for elementary science.

Santa Clara Unified School District

Overview of data collected through observations of classrooms taught by BaySci participants, BaySci participant interviews, and BaySci participant surveys.

Science Instruction

Interviewed teachers reported teaching more science since joining BaySci and reported enjoying the experience. Teachers also reported linking writing with science lessons more often since joining BaySci. Comments in interviews are consistent with teacher responses to the BaySci survey. In the survey teachers reported a slight increase in the amount of science they teach since joining the program.

Teachers participating in the survey reported on how often they teach science and how long their typical science lesson lasts. Teachers also indicated if there was any difference between how much science instruction they offer now and before participating in BaySci.

Table 1. Change in science instruction frequency and duration as reported by Santa Clara teachers. Source: BaySci survey, N=11 teachers.

At the time of completing survey	Average frequency of science lessons weekly	3.20
	Average duration of science lessons (in minutes)	48.5
	Average of individual teacher’s weekly minutes	139.5
Change Since joining BaySci[38]	Change in frequency	-0.30
	Change in duration (in minutes)	5.0
	Change in weekly minutes (frequency x duration)	9.0

We asked teachers how often they ask students to carry out each of the science and engineering practices from the Next Generation Science Standards (NGSS). We also asked whether teachers noted any change in how often they asked their students to engage with the practices since participating in BaySci. Table 3 (below) summarizes teacher responses to these questions. Table 3 reflects an increase in enactments of NGSS practices with particular

[38] Calculated by subtracting the pre-BaySci values from the present values, positive numbers indicate increase

increases noted for engaging in argument from evidence and obtaining, evaluating, and communicating information.

Table 2. Teacher report on how frequently they ask students to carry out science and engineering practices. Source: 2013 BaySci survey.

NGSS Science and Engineering Practices	How often do teachers report asking students to carry out NGSS practices?[39]					More often since starting BaySci?
	Never / almost never (<10%)	Rarely (10-30%)	Some-times (30-60%)	Often (60-90%)	Always (>90%)	
Asking questions and/or defining problems	0%	0%	36%	43%	14%	36%
Developing and using models	7%	36%	29%	21%	0%	36%
Planning and carrying out investigations	0%	14%	43%	29%	7%	18%
Analyzing and interpreting data	7%	14%	57%	7%	7%	45%
Using mathematics and computational thinking	29%	29%	21%	14%	0%	27%
Constructing explanations and/or designing solutions	7%	14%	36%	29%	7%	64%
Engaging in argument from evidence	7%	36%	29%	21%	0%	82%
Obtaining, evaluating, and communicating information	0%	21%	7%	43%	21%	82%

In a similar set of questions, we asked teachers how often they asked students to engage in activities that link science with language arts. Table 4 (below) summarizes teacher responses to these questions. These data suggest that science notebook use is widely adopted in Santa Clara and that there has been an increase in both types of writing tasks. It appears also that extended reading may have been common in Santa Clara before becoming a BaySci district.

[39] Percentages refer to the percent of science lessons offered.

Table 3. Teacher report on how frequently they ask students to engage in activities that link science with language arts. Source: 2013 BaySci survey.

Activities that link science with language arts	How often do teachers report asking students to carry out NGSS practices?[40]					More often since starting BaySci?
	Never / almost never (<10%)	Rarely (10-30%)	Some-times (30-60%)	Often (60-90%)	Always (>90%)	
Working in science notebooks	0%	7%	14%	43%	36%	55%
Writing science reflections	0%	43%	14%	36%	7%	64%
Extended science reading	14%	21%	29%	36%	0%	27%
Other assignments that link science and language arts	0%	21%	50%	0%	7%	36%

Leadership and Culture

We asked survey respondents (all BaySci participants) to rate their agreement with several statements related to district leadership and culture. Respondents had five options ranging from "strongly agree" to "strongly disagree". We also asked respondents if they thought these aspects of leadership and culture had changed for the worse, for the better, or shown no change since the district started participating in BaySci. Table 4 (below) shows the percentage of teachers who selected "agree" or "agree strongly" for each of the statements and the percentage who report change for the better since BaySci.

Santa Clara teachers report high levels of support and leadership with respect to professional development opportunities. At the district level, they report improvements in professional development support. District level ratings for leadership and culture that is supportive of science were higher than school level ratings suggesting that science improvement efforts have been more centralized.

[40] Percentages refer to the percent of science lessons offered.

Table 4. Level of agreement and change ratings related to several dimensions of leadership and culture. Source: BaySci 2014 participant survey.

Statement	Level of agreement: "Strongly agree" or "agree"	Change since BaySci? "for the better"
The importance of including science curriculum has been clearly communicated to all teachers by school leadership.	36%	27%
The school supports teachers in participating in professional development activities.	91%	27%
The district supports teachers in participating in professional development activities related to science.	100%	64%
Teachers know where to get their technical or pedagogical questions answered for science instruction in the classroom.	36%	9%
Teachers consider me a resource to address their technical or pedagogical needs for science instruction.	45%	36%
My school has made policies that facilitate science instruction in the classroom.	27%	9%
My district has made policies that facilitate science instruction in the classroom.	64%	9%

Teacher Leadership Academy and Master Group Seminar Participant Surveys (Inverness Research)

In February 2014, Inverness Research surveyed Teacher Leadership Academy and Master Group Seminar participants. From the 56 completed surveys, common findings emerged across all districts. We have organized these into two categories – Usefulness of BaySci Offerings and Awareness of and Connection to District Efforts to Improve Elementary Science.

Usefulness of BaySci Offerings

- A large majority of participants reports that the BaySci Teacher Leadership Academy and Master Group Seminar offerings are extremely or very useful in terms of furthering their own professional learning and improving their elementary science instruction.
- Based on their participation in BaySci, about half of the respondents feel extremely or very empowered or encouraged to take on leadership roles related to elementary science teaching in their schools and districts.
- More than half indicated that they would like BaySci to provide more leadership training and support in taking on leadership roles in elementary science teaching.

Connection to District Efforts to Improve Elementary Science

- About 2/3 of the teachers are aware of their of their district's vision statement.
- Slightly less than 2/3 are aware of their district's plans to improve elementary science education.
- We received a wide range of responses to the question: To what extent do you feel connected to the overall effort to improve science education in your district? These vary from feeling extremely and very connected to somewhat connected, to slightly or not at all connected.
- Almost 70% of teachers report that it's not clear to them how the district wants to use teacher leaders, like the TLA and MGS participants, to accomplish its plans for elementary science.

Science Champions Strand

We have provided some elements of a data overview using data from the Science Champions Strand. Note that this includes data from two teachers; Champions strand members from Orinda, who are also included in the district level breakdown.

Teachers participating in the survey reported on how often they teach science and how long their typical science lesson lasts. Teachers also indicated if there was any difference between how much science instruction they offer now and before participating in BaySci.

Table 1. Change in science instruction frequency and duration as reported by Science Champions Strand teachers. Source: BaySci survey, N=64 teachers.

At the time of completing survey	Average frequency of science lessons weekly	3.41
	Average duration of science lessons (in minutes)	49.8
	Average of individual teacher's weekly minutes	169.4
Change Since joining BaySci[41]	Change in frequency	-0.09
	Change in duration (in minutes)	4.5
	Change in weekly minutes (frequency x duration)	12.5

We asked members of the Science Champions Strand how often they ask students to carry out each of the science and engineering practices from the Next Generation Science Standards (NGSS). We also asked whether teachers noted any change in how often they asked their students to engage with the practices since participating in BaySci. Table 3 (below) summarizes teacher responses to these questions.

[41] Calculated by subtracting the pre-BaySci values from the present values, positive numbers indicate increase

Table 2. Teacher report on how frequently they ask students to carry out science and engineering practices. Source: 2013 BaySci survey.

NGSS Science and Engineering Practices	**How often do teachers report asking students to carry out NGSS practices?**[42]					**More often since starting BaySci?**
	Never / almost never (<10%)	**Rarely** (10-30%)	**Some-times** (30-60%)	**Often** (60-90%)	**Always** (>90%)	
Asking questions and/or defining problems	0%	11%	0%	38%	39%	80%
Developing and using models	3%	25%	0%	38%	30%	52%
Planning and carrying out investigations	0%	16%	0%	38%	41%	72%
Analyzing and interpreting data	0%	11%	0%	44%	41%	64%
Using mathematics and computational thinking	5%	28%	0%	47%	22%	39%
Constructing explanations and/or designing solutions	2%	16%	0%	39%	36%	80%
Engaging in argument from evidence	6%	14%	0%	38%	36%	80%
Obtaining, evaluating, and communicating information	2%	9%	0%	42%	27%	72%

In a similar set of questions, we asked teachers how often they asked students to engage in activities that link science with language arts. Table 4 (below) summarizes teacher responses to these questions.

[42] Percentages refer to the percent of science lessons offered.

Table 3. Teacher report on how frequently they ask students to engage in activities that link science with language arts. Source: 2013 BaySci survey.

Activities that link science with language arts	How often do teachers report asking students to carry out NGSS practices?[43]					More often since starting BaySci?
	Never / almost never (<10%)	Rarely (10-30%)	Some-times (30-60%)	Often (60-90%)	Always (>90%)	
Working in science notebooks	3%	3%	6%	22%	38%	64%
Writing science reflections	3%	17%	20%	36%	36%	69%
Extended science reading	8%	23%	31%	36%	27%	39%
Other assignments that link science and language arts	16%	8%	23%	34%	27%	36%

Teacher Leadership Academy and Master Group Seminar Participant Surveys (Inverness Research)

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Usefulness of BaySci Offerings

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- More than half indicated that they would like BaySci to provide more leadership training and support in taking on leadership roles in elementary science teaching.

Connection to District Efforts to Improve Elementary Science

[43] Percentages refer to the percent of science lessons offered.

- About 2/3 of the teachers are aware of their of their district's vision statement.
- Slightly less than 2/3 are aware of their district's plans to improve elementary science education.
- We received a wide range of responses to the question: To what extent do you feel connected to the overall effort to improve science education in your district? These vary from feeling extremely and very connected to somewhat connected, to slightly or not at all connected.
- Almost 70% of teachers report that it's not clear to them how the district wants to use teacher leaders, like the TLA and MGS participants, to accomplish its plans for elementary science.

Appendix C. Memo on the BaySci SREI Learning Community Interviews (November, 2013)

Introduction and Programming Description

In this document, we report briefly on the activities of the BaySci SREI learning community in the first year and then provide an overview of the value and promise of the BaySci activities in the learning community as described in interviews with organizers, participants, and leadership from participating SREIs.

In July of 2012, a design team made up of 10 individuals from 6 organizations plus 4 staff from Inverness Research met. At that meeting, the group discussed professional development needs that span the institutions and decided on topics they would like to explore further.

In November 2013, to follow up on the work from the initial design team meeting, an expanded design team met to work on more detailed planning and implementation. At this meeting, it was decided that two common interests across organizations included NGSS and a study group on learning research. Participants agreed to take on specific aspects of planning and design for future meetings. Representatives from different SREIs agreed to take on aspects of planning and hosting each subsequent event.

In April 2013, representatives from eight SREIs and the two BaySci evaluation groups attended the NGSS Workshop, Part I "Primer" hosted by the California Academy of Sciences. Facilitation organized in advance by representatives of the California Academy of Sciences and Monterey Bay Aquarium were unable to lead the events and last-minute arrangements were made for Craig Strang at Lawrence Hall of Science to lead the activities.

Three meetings of the Learning Research Study Group were held in May, June, and July 2013. Participants read scholarly works on discourse in science classrooms, met to discuss the readings and draw connections between the readings and the NGSS transition.

According to Inverness Research, "53 individuals participated from the six initial institutions, and of those, 16 people participated in two or more activities. There were 5 individuals from the two additional institutions, 2 of which came to more than one event." (presentation at LHS, Sept. 3, 2013)

Methods

Data supporting this analysis comes mainly from interviews with programming participants, organizers, and education leaders at SREI institutions. In addition to interviews, we attended 2 events and listened to one planning call.

We initially sent out invitations to 16 participants who had attended at least two SREI strand activities. Of those invited, 2 were not available (one had left the organization and we had no forwarding information, the second was on an extended leave from work). Of the 14 remaining individuals, we were able to coordinate and conduct interviews with eight. We then extended our invitations to an additional 7 individuals in a leadership role within their SREI, whether or not they had been able to attend one of the related events. Four of these individuals expressed interest in talking with us about their experience with the BaySci SREI strand activities, and we were able to schedule interviews with two within the allotted time. The fifth individual who we did not connect with had an incredibly busy schedule and had not personally attended any of the BaySci SREI events.

We conducted 11 telephone interviews with people who attended at least one BaySci event for SREI professionals between July 2013 and July 2014. The participants included one individual who attended all 5 BaySci SREI strand events during the designated period of time, 3 who attended 3 events, 6 who attended 2 events, and one who attended a single event.

Interviewees represented six (6) different Bay Area SREI institutions - 2 individuals each from 5 institutions and 1 individual from the last institution. We interviewed people with varying levels of experience in the field ranging from people involved in curriculum development to education department directors. Some interviewees were involved in the planning and organization of SREI strand activities. Exhibit 1 (below) shows details on interviewee participation in programming and roles in institutions.

Interviews took between 25 and 45 minutes each, we asked different sets of questions based on the activities they participated in, whether they were involved in SREI strand planning, and their roles in their institutions. We were interested in learning of any benefits for the individual professional development of SREI educators who support schools and districts as well as any impact of the activities on fostering a healthy learning community among SREI educators.

Exhibit 1. Interviewee profiles

SREI Strand Interview Participants by event					
	PROGRAM ORIENTATION	NGSS PRIMER	STUDY GROUP 1	STUDY GROUP 2	STUDY GROUP 3

	11/2012	4/2013	5/2013	6/2013	7/2013
NUMBER OF ATTENDEES INTERVIEWED	9	6	5	3	4
NUMBER OF INSTITUTIONS REPRESENTED IN INTERVIEWS	5	4	4	2	3
JOB CATEGORIES OF INTERVIEWEES					
DIRECTOR	3	2	2	1	1
MANAGER/COORDINATOR	1	1	1	1	1
EDUCATOR	2	1	1	1	2
SPECIALIST (RESEARCH, PD, CURRICULUM DEVELOPMENT)	3	2	1	-	-

In addition to interviews, SRI researchers attended the NGSS workshop event at California Academy of Sciences on April 29, 2013 and the July 23, 2013 SREI strand study group at the Exploratorium. We also participated in one of the study group planning calls.

Most interviews were carried out by a team of two SRI interviewers. We took notes on each interview, categorized comments thematically, and organized comments and ideas to develop this collection of findings and observations.

After completing the interviews, we identified 3 categories of impacts that respondents described: individual benefits (of participation), community benefits, and indirect impacts on school programming and schools. The notes below describe (or quote from) interviewee comments in each of the categories. We have also summarized formative feedback provided by respondents that did not fit into any of the above categories.

Results

Comments of interviewees are recorded here as notes and organized thematically within the main categories described above; individual benefits, community benefits, and indirect impacts on school programming. Some additional comments are summarized in a fourth section titled formative feedback,

Unless otherwise indicated, each bullet represents the remarks of a single person . Note that these are themes identified from open-ended questions about the BaySci SREI community not responses to structured questions.

1. Individual benefits

Here we grouped comments concerning individual benefits that participants such as appreciating the opportunity to meet and see colleagues or learning something new.

Several participants commented on the value of face-to-face time:

- "It's great to get together with colleagues and have these conversations, it's a great opportunity"
- It was good to be with others and see what they are doing. The meetings give you a chance to increase the depth of the connections you already have with others.
- One participant mentioned being new to the informal learning community and enjoyed getting to go to the meetings to meet people and start to get oriented.
- One participant said it's good to see everyone in the same room. This person is fairly new to the field and was glad to meet others and put faces to names, but does not yet feel very connected or know the expertise everyone brings to the table.
- Good to have a chance to talk with people in the community of SREI educators.
- The richness in having in-person meetings - is that you can't overestimate the ability of conversation to breed rich "a-ha" moments.
- Did not meet anyone new at these events but re-connected with people s/he already knows who work in this area.

There were also many comments about appreciation of chances to work closely with others :

- A senior level person who participated in the planning activities appreciated the chance to work closely with colleagues from other institutions "It was nice to work with these people and get their perspectives on these ideas and the way that they conduct workshops and design experiences."
- One participant said it is a wonderful opportunity when you can collaborate and interact with colleagues in the field. Found the small groups to offer more of an opportunity to explore. Referred to experiences like these as, "always a great networking opportunity".
- Note that both of the above comments came from seasoned SREI professionals. At least one more junior person commented that it was nice to get to talk with people and that there is an interest in actually working together suggesting that the collaboration for this individual hadn't yet begun.

Several people noted that it is rare for SREI staff to have opportunities to participate in professional development (PD), especially PD relevant to target content of the programming they offer (e.g. discourse or NGSS transitions)

- Being a member of the design team, in and of itself, offered an opportunity for learning, in addition to looking at different articles and thinking about what is important to think about as a larger community.

- One person reported getting a lot of value from different perspectives about science discourse.
- Staff members in one respondent's institution don't do as much article sharing and discussing normally as they got to do as part of preparing for and participating in the reading groups. Usually, when a relevant article comes up, people in one institution will pass it around. If it seems extremely important, they might make time to talk about it, certainly try to integrate it into their thinking - but generally, they are so busy planning, developing and delivering workshops; looking for new work; and engaging in the day to day involvement with teachers, that they don't set aside the time/space to really dig deeply into new literature. For this reason, people who participated in study groups, even if only partially, got a lot out of it.
- The importance of the framework was really highlighted during the full day NGSS workshop session. One participant would otherwise have just looked through the standards themselves, without that broader sense of context.
- One person made a general statement about the value of PD: There is always room to grow more and the more interactions they have as institutions, the more they learn from each other and the better they get as professional developers.

There were some comments about learning about access to resources:

- When asked if participants learned about or gained access to any new resources through BaySci SREI Learning Community activities, one director said, "Yes [...] you find out about things you wouldn't otherwise because how could you?"
- One participant commented that she learned about resources.

2. Community Benefits

In this section, we have compiled comments about benefits to the SREI professional community such as comments on how the SREI Learning Community strengthens institutions and ties between institutions.

For some people, the SREI Learning Community provided opportunities for early stages of getting to know the professional community:

- While people in director level positions seemed to already know their counterparts from other institutions, one director said that for the more junior people on the staff (programming managers, etc.…), the SREI activities were a good opportunity to meet their counterparts and it was a relief to learn that everyone struggles with the same issues. Thought that for many participants, there was a lot of common ground in terms of roles between institutions.
- There is value in opportunities to gather - not just for creating and identifying areas in which they might be able to support each other in learning, but also in terms of

connecting with people that they work with in a variety of ways on a variety of projects.

- They (we) almost never get a chance to sit down as an equal party of learners to create a community around the ideas that they work with but don't often get a chance to reflect on.
- One participant met at least 3 new cross-institution colleagues that s/he intends to keep in touch with. Got most out of interactions with people who attended multiple events. - note that the latter part of this supports the notion that building community takes time.
- The readings gave us a common vocabulary and made us think more about Science Talk; the reading group got us to sit down and talk about what Science Talk is and what might it look like.

Some people commented on challenges to collaboration:

- They (as an institution) talked about collaborating with different museums during these BaySci events. Although nothing has come out of that so far, participant felt it was valuable because they tend to find themselves in more of a competitive than a collaborative mindset. They are not really collaborating (everyone goes back to their museum and does their own thing) but now they feel a lot of pressure to be the focal point - they think they should get something out there first. This participant would prefer to have more collaborative efforts, but is not in a position to influence those decisions.
- Two respondents (from the same institution) commented on the fact that there can be competition between SREIs - not just about funders but also competition for teacher audiences. Ideally, a teacher can take her kids to every science center in the area but "if a teacher has to choose only one, I hope they will choose [name of institution]".
- For the more junior respondent, the competition issue may best be overcome when more senior staff are involved - the director-level involvement is necessary for friendly interactions to turn into partnerships.
- There is an overlap of funders and an overlap of projects so this individual sees people in the other SREIs a lot. But those meetings tend to be on more specific topics, time to be reflective with people from the other institutions is important.
- One person (who was not at leadership level) said that people are interested in collaboration but they do not always have control to make that happen. Staff who attended the reading groups shared briefly about the experience in a staff meeting, but they have not created an opportunity to share more deeply with staff who were not able to attend.
- It's rare for people from all of these institutions to be in the same room at once, in terms of building more of a community between the SREIs, it is good but there needs to be more of it.

Several people commented on the new collaboration that is developing. Chabot and Monterey Bay Aquarium have begun meetings of counterparts at each institution who design and offer PD to teachers.:

- One participant was anticipating a future collaboration with another institution and felt that the meetings were an opportunity to deepen relationships. Another comment (from the same person) commenting on this new collaboration noted that it felt good to be with the other people and that it didn't feel like they were competing.
- One interviewee explained that "Inverness has continued to nurture, foster, and broker (the partnership)" and told us that on Sept. 17th, 2013, the relevant Chabot department drove to spend the day meeting with their counterparts at MBA. They wanted to visit one another's summer programming but there was no time. The goal is to learn how they can partner on the more detailed side of offering PD, not just promote one another's work. They hope to be able to work together).

There were several remarks about the timeliness of the topic for the challenges that the institutions face today. SREIs share a common challenge there were comments that now is a good time for sharing

- NGSS is going to be a huge change, long overdue but "where teachers are and where they need to be is so far apart" – One respondent is interested in what other institutions are doing about this problem and mentioned being proud of what her institution is doing.
- One participant thought it is pretty impressive the extent to which SREIs already have a habit of keeping one another informed in ways that benefit all institutions. But also noted that in these institutions, PD is rare (for non-profits in general). Most PD is left to individuals and there is almost always a resource issue. PD gets cut out of budgets. The introduction of NGSS means there's a lot of new things coming down the pipeline and people in these roles need PD.

There was interest in contrasting views and approaches to the NGSS transition:

- One participant said it's really nice to see where other organizations are on important topics.
- Another interviewee was pleased to get a better understanding of what others are working on / how others see important issues (sometimes differently).
- One person said something similar, that it was valuable for her to see how many different ways people in the field are thinking about these issues.
- Participant and colleagues know about the breadth of programming SREIs offer but they can only do what funders want to pay for. It was interesting to learn what other institutions are getting funding for.
- Talking through readings and different schools of thought on science talk - Thinking of it in terms of discourse and argumentation, is a very particular way of thinking about science talk in the classroom (vs. thinking about science talk as everyday language

use). There is overlap in these ideas, but the way people write about them, and think about them, are different.

- One participant has gotten a lot (“ton”) out of each conversation. - The way this person sees “talking in science” is different from someone at another institution that is working more with people in classrooms, bringing in scientists, is different than what this person’s organization does. World of science is eclectic and there are lots of points of view to learn from.

3. Impacts on the work of SREI institutions

Some participants talked about how they take what they gain from BaySci back to their institution:

- One person valued creating the opportunity to read a document, get together and talk about it provided a rich breeding ground for development and then they were able to bring these ideas back to their own institutions and make these things happen more often in real time and real life.
- Event on NGSS that was held at Cal Academy was a great overview on the standards as well as some inspiration about how all of us in this community can support them [the standards] and work together and support teachers in this time of change with the new standards. “It was time very well spent that day.”

Programming like this will take time to impact the SREI offerings to schools and teachers. BaySci (SREI strand) supports transitions that are already underway.

- One participant thinks it’s too soon to talk about impacts of these efforts on the work they do in schools as this was just a first set of meetings.
- Another person said something similar, that the programming they offer today was designed before and that the cycles for things to change will be more gradual. Programming is not getting overhauled, improvements are incremental.
- One person said their organization was already planning a Common Core / NGSS upgrade to programming but BaySci set a fire under them to get new lessons planned and promoted.
- One person said that a number of their programs are in flux, in large part because funding is in flux. Almost all program changes moving forward will reference NGSS (can’t really say that is because of BaySci, but just the way the climate is moving). BaySci has given them more guidelines for teachers around science talk – encouragement to do more with them around science talk in their classrooms.
- Some work in programming happening at the SREIs can be shaped by the BaySci experience. One person’s organization is developing programming for English language learners around talk and science. The discussions with study groups has been helpful for that process.

4. Formative feedback

Several participants offered praise for the programming in general

- In one participants words, the SREI strand is a "Very worthy endeavor"
- The orientation and NGSS meetings were helpful. (from a person who was not able to attend the study groups).
- One participant's memory of the planning day was very positive. The activity of getting together with everyone at the Cal Academy and generating ideas was really useful.
- Two people praised the NGSS workshop for overall high quality. They found it extremely valuable. It was very timely and they shared information with their teachers and they are continuing to work with it.
- It was nice that the meetings helped people think "outward" beyond just their organization.

Comments about what some participants would like to see in future events:

- Two more senior level people commented that the content of the study groups was not really at their level. They felt that they already came in with more expertise and familiarity with the readings. One of the two noted that there was a wide range of interest and knowledge in the group in this topic area (perhaps noting the challenge of designing programming for meeting all of the needs)
- Two people wanted to see more emphasis on practice: One person was interested in more training around the "nitty-gritty" for curriculum developers thinking about NGSS. Another said that reading the articles has been helpful, but more on the practice and what it looks like would be helpful.

Several people commented on logistical concerns for future programming:

- Trainings are too far away for some individuals to do the short ones.
- Timing is hard for all of us. Getting together involves travel and 2-hour study groups do not always feel worth the 2 hours (or more) of travel to reach various locations around the Bay Area.
- Summer is not the best timing for many SREI professionals to participate in PD activities. Most have already set their programming for the fall and coming school year. It is also difficult to be consistent because of conferences and vacation schedules.

Many participants wanted to talk about what happens next:

- This is a valuable opportunity, Respondent is "curious about where we're going to take it from here".
- One person would like to see the next step be something with more of a deep dive. There are people in the Bay Area who have spent years working on discourse in science classrooms and are real experts - she'd like to have such an expert come into the field

for us, what we would like to do is dive into some of the issues and practices we are facing more deeply.

- What has happened has worked well. Would like to have more sessions on NGSS (as those are unfolding).
- One person would be open to working with a smaller group of people – maybe multiple groups of 5-7 people who could mentor one another in a way – people of similar levels at different institutions could bring concerns to one another for support
- It's important to make sure the group atmosphere stays focused on collaboration and not competition at the meetings.

Appendix D. BaySci Survey Responses on Leadership and Culture Items

	STRAND	Strongly Agree	Agree	Neutral	Disagree	Disagree Strongly
Teachers know where to get their technical or pedagogical questions answered for science instruction in the classroom	DS	8%	39%	29%	19%	6%
	CS	9%	30%	37%	15%	9%
	ALL	**8%**	**36%**	**31%**	**18%**	**7%**
Teachers consider me a resource to address their technical or pedagogical needs for science instruction	DS	16%	40%	31%	12%	1%
	CS	19%	40%	23%	17%	0%
	ALL	**17%**	**40%**	**29%**	**14%**	**1%**
There is a clear channel for communicating my science education needs in my school or district	DS	14%	42%	21%	17%	6%
	CS	18%	39%	27%	11%	5%
	ALL	**15%**	**41%**	**23%**	**15%**	**6%**
There are enough pedagogical materials (e.g. textbooks, other media) available to meet my needs for science	DS	15%	46%	16%	19%	4%
	CS	21%	47%	13%	16%	3%
	ALL	**17%**	**47%**	**15%**	**18%**	**3%**
There are enough other science materials (e.g. well-stocked kits) available for class and lab activities.	DS	27%	47%	7%	14%	4%
	CS	34%	40%	6%	18%	2%
	ALL	**30%**	**45%**	**7%**	**15%**	**3%**
There is support available from my school or district for addressing any challenges I face in science instruction.	DS	17%	41%	23%	15%	4%
	CS	19%	45%	16%	15%	5%
	ALL	**18%**	**43%**	**21%**	**15%**	**4%**
The school supports teachers in participating in professional development activities related to science	DS	34%	50%	7%	8%	1%
	CS	28%	51%	17%	4%	0%
	ALL	**32%**	**50%**	**10%**	**7%**	**1%**
The district supports teachers in participating in professional development activities related to science	DS	27%	49%	13%	10%	2%
	CS	23%	53%	9%	15%	0%
	ALL	**26%**	**50%**	**11%**	**11%**	**1%**
My school has made policies that facilitate science instruction in the classroom.	DS	12%	29%	27%	24%	9%
	CS	15%	30%	30%	19%	6%
	ALL	**13%**	**29%**	**28%**	**22%**	**8%**
My district has made policies that facilitate science instruction in the classroom	DS	14%	33%	23%	21%	10%
	CS	13%	32%	28%	28%	0%
	ALL	**14%**	**32%**	**24%**	**23%**	**7%**

Appendix E. California 5th Grade STAR (CST) Science Test Results for BaySci Districts, 2007-2013

Districts participating in BaySci since 2008

The year highlighted in yellow indicates the first year of BaySci involvement.

	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013
PETALUMA CITY ELEMENTARY							
n (number of test scores)	298	256	248	254	278	278	277
Mean score	345.6	361.9	373.5	372.8	374.4	385	377.8
% Advanced	13%	21%	26%	29%	26%	36%	25%
% Proficient	34%	38%	32%	37%	39%	32%	39%
% Basic	33%	25%	33%	19%	23%	24%	26%
% Below Basic	12%	11%	7%	10%	6%	5%	6%
% Far Below Basic	8%	5%	2%	5%	6%	2%	3%

NOVATO UNIFIED							
n (number of test scores)	595	586	609	557	574	584	612
Mean score	360.1	365.8	374.1	381.5	390.8	391.6	385.2
% Advanced	20%	22%	27%	36%	38%	37%	33%
% Proficient	37%	40%	36%	33%	34%	40%	38%
% Basic	30%	25%	22%	20%	20%	16%	22%
% Below Basic	7%	8%	9%	7%	5%	5%	5%
% Far Below Basic	6%	6%	5%	4%	3%	2%	2%

NEWARK UNIFIED							
n (number of test scores)	495	504	517	438	448	432	411
Mean score	335.3	352.8	356.3	358.8	360.8	356.4	363.4
% Advanced	8%	13%	16%	18%	19%	18%	21%
% Proficient	32%	39%	34%	39%	35%	36%	35%
% Basic	34%	32%	34%	26%	29%	28%	30%
% Below Basic	15%	12%	10%	10%	12%	11%	11%
% Far Below Basic	11%	4%	5%	7%	4%	8%	4%

Districts participating in BaySci since 2011

The year highlighted in yellow indicates the first year of BaySci involvement.

	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013
OAKLAND UNIFIED							
n (number of test scores)	3044	2914	2931	2753	2993	2875	2810
Mean score	317.4	328.8	332	342.5	348	354.2	352.2
% Advanced	6%	10%	11%	17%	17%	21%	18%
% Proficient	20%	26%	22%	27%	29%	29%	28%
% Basic	36%	31%	35%	29%	28%	29%	33%
% Below Basic	21%	17%	17%	16%	16%	12%	12%
% Far Below Basic	18%	16%	15%	12%	11%	10%	9%
SANTA CLARA UNIFIED							
n (number of test scores)	1045	1041	1016	986	1069	1036	1047
Mean score	347.6	361.4	375.5	386.4	389.4	392.6	390.2
% Advanced	15%	18%	28%	36%	37%	37%	34%
% Proficient	31%	40%	35%	33%	32%	34%	34%
% Basic	31%	27%	24%	22%	22%	20%	23%
% Below Basic	13%	10%	8%	6%	6%	5%	5%
% Far Below Basic	9%	5%	5%	3%	3%	3%	3%
ALAMEDA CITY UNIFIED							
n (number of test scores)	695	751	646	682	693	633	698
Mean score	352.2	365	377.7	378.3	390.1	377.9	388.3
% Advanced	14%	20%	31%	33%	36%	31%	34%
% Proficient	39%	43%	33%	35%	39%	38%	36%
% Basic	29%	26%	24%	19%	17%	20%	21%
% Below Basic	9%	7%	7%	10%	6%	7%	5%
% Far Below Basic	8%	5%	5%	3%	2%	4%	4%

*CST Science test scores for Petaluma, Novato, and Newark derived from previous Inverness Research report

We have not explored test score data for districts that joined the BaySci District Strand after 2011. Because of the lag in test scores, we would not be able to see a trajectory of change for these districts.

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