

UNLOCKING LEARNING: SCIENCE AS A LEVER FOR ENGLISH LEARNER EQUITY



The Education Trust—West

UNLOCKING LEARNING: SCIENCE AS A LEVER FOR ENGLISH LEARNER EQUITY



The second-grade classroom at Christopher Elementary School in San Jose, California, is alive with academic conversation as students — 54 percent English learners — work in small groups at “learning stations.” During part of a life science unit, one group is using magnifying glasses to examine sea urchin shells and dried starfish, while another group examines snails. Students work excitedly with the specimens as they make observations and compare the diversity of animals in different habitats. Students at another station work in pairs at laptops to find information about seashore birds and their environment. At a third table, students match animal figures with photograph habitat cards and read detailed descriptions about each animal.

At first glance, the scene may seem no different than the many other classrooms across California that use learning stations. But there is a rare level of coherence and intentionality. This school — and the Oak Grove School District — adopted the Sobrato Early Academic Language (SEAL) program, which centers on rigorous academic home language and English language development through the coordinated study of science and social studies thematic units.

The walls are covered with poster boards, but these are hardly random. Each poster contains chants with highlighted science vocabulary words that are color-coded to match key words in sentences on a white board, which also are repeated on index cards at each of the learning stations. The result? A vibrant learning environment that motivates students to engage in practicing spoken language, written communication, and meaningful cognitive tasks. Language development is the vehicle for learning science. It’s a reciprocal process as students learn to speak like scientists and use science learning to build language skills.

Authors: Sarah Feldman, *Director of Practice* and Verónica Flores Malagon, *Senior Practice Associate*

The students in this Oak Grove School District classroom are experiencing what research indicates: that, done right, science education has enormous potential to advance language development for English learners (ELs).¹ Scientific literacy unlocks skills across the learning spectrum and can be a powerful lever for education equity, not to mention a gateway to economic mobility.

However, access to science education in California is highly unequal, and English learners are among the most shortchanged. Despite the fact that more than one out of every five students in California K-12 public schools is an English learner,² these students are less likely to attend elementary schools where teachers report they have adequate time for science, less likely to complete the rigorous secondary science courses required for admission to the state's public universities, and, in middle and high school science courses, less likely to be taught by teachers with a strong science background. Furthermore, affluent schools were more than twice as likely to report launching science initiatives than the state's poorest schools.³

But it doesn't have to be this way. The confluence of several major state policy initiatives in California creates a rare opportunity to advance opportunities and achievement for English learners through high-quality science education. Currently, districts are required to implement the California Common Core State Standards (CCSS), the California English Language Development Standards (CA ELD Standards), and the California Next Generation Science Standards (CA NGSS), all of which demand more sophisticated approaches to meeting the needs of English learners and other subgroups of students. At the same time, the Local Control Funding Formula (LCFF) allocates dollars to districts based on the number of ELs enrolled and the Local Control and Accountability Plan (LCAP) process requires districts to identify how they will improve outcomes for ELs. Together, these policies present a rare opportunity for state and local education leaders to prioritize equity — especially for English learners — when implementing the state standards.

Most recently, the passage of California's Proposition 58 is ushering in opportunities to better educate English learners through bilingual programs and the use of students' native languages in classroom instruction. Passed in November 2016, Prop. 58 repeals 1998's Proposition 227, which required California public schools to deliver instruction primarily in English. Prop. 58 allows

schools more opportunities to implement bilingual/biliteracy programs and no longer requires English-only education for English learners.

What would it actually look like for district or state leaders to prioritize equity for English learners in standards implementation? Because the science and ELD standards are relatively new — and the idea of coordinated implementation even more so — we turned to the data. Our first goal was to see what data could tell us about where we are now as a state. Then, we wanted to identify and learn from districts and schools that are doing better than the state as a whole and proactively using science learning to advance achievement for English learners.

This report shares what we learned. We begin by reviewing the data on ELs and science. We then focus on a handful of leading districts. Finally, we lay out a set of recommendations for how state and local leaders can promote English language development integrated with high-quality science education opportunities.

WHO ARE ENGLISH LEARNER STUDENTS IN CALIFORNIA?

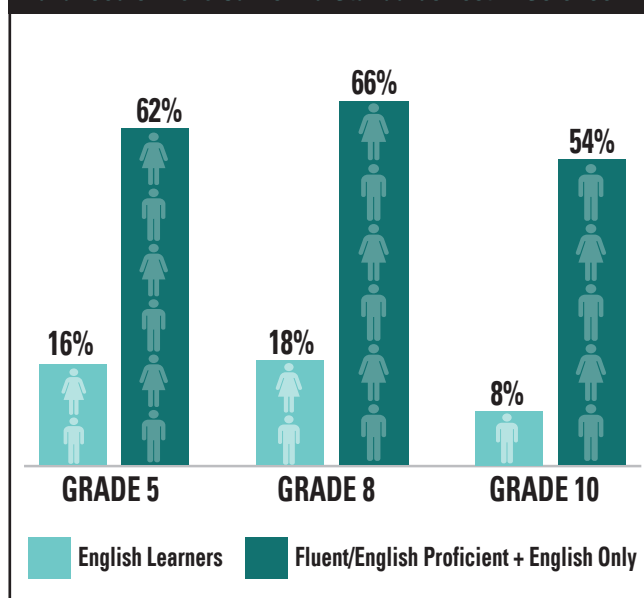
- 1.37 million public school students in California are English learners. This is more than one out of every five students.⁴
- 44 percent of Californians over age 5 speak a language other than English at home. California's ELs speak more than 60 different languages, bringing linguistic and cultural diversity to California public schools.⁵
- EL students live in nearly every California community. In 2015-16, Los Angeles Unified served the most EL students — 165,450 (26 percent of students). Many other districts serve higher percentages of EL students than the statewide average of 22 percent, such as Santa Ana Unified's 23,500 (42 percent of students) and Garden Grove Unified's 17,745 (39 percent of students).⁶

ENGLISH LEARNERS FACE OPPORTUNITY AND ACHIEVEMENT GAPS IN SCIENCE

English learners in California consistently score below the general student population on science assessments, mirroring EL performance in other subjects. This is true on both state and national assessments.

- On the 2015 National Assessment of Educational Progress in science, fourth and eighth-grade EL students in California scored considerably lower than their English fluent counterparts. For example, only 3 percent of fourth-grade English learners in California performed at or above the proficient level, compared with 32 percent of fluent English speakers. Similarly, just 2 percent of eighth-grade ELs performed at or above the proficient level, compared with 27 percent of fluent English speakers.⁷ Moreover, California's English learners perform considerably below English learners in many other states—often in the bottom quartile nationally. It is important to note that the NAEP is administered in English only.
- On the California Standards Test (CST) in science, there are also worrisome patterns. A substantial majority of fluent English speakers — 62 percent in fifth grade, 66 percent in eighth grade, and 54 percent in 10th grade — scored proficient or advanced in 2016. But only 16 percent of fifth-grade, 18 percent

FIGURE 1: Percent of Students Scoring Proficient or Advanced on 2016 California Standards Test in Science



Source: California Department of Education, 2016 CAASPP CST Science Results

of eighth-grade and 8 percent of 10th-grade English learners scored proficient or advanced on the 2016 science CST.

The achievement data are just the tip of the iceberg. Underneath, other data point to seriously different opportunities to learn.

- By law, for example, ELs are generally assigned extra instructional minutes in English language arts as designated ELD time. Yet some students receive that additional instruction during other classes, such as science. The fact is, they should get both.
- Statewide, only 9 percent of ELs complete the 15 A-G courses required to be eligible for admission to a California State University (CSU) or University of California (UC) campus, compared with 43 percent of all students.⁸ In high school, English learners do not have the same access to rigorous science courses and are underrepresented in lab science classes and other college preparatory coursework.⁹
- In California, only 58 percent of high schools even offer chemistry, 51 percent offer physics, and 7 percent offer math courses titled advanced.¹⁰ Only 11 percent of ELs attend schools that offer the “advanced” math courses, and ELs are less likely than their non-EL peers to be enrolled in these courses when available.¹¹





SCIENCE EDUCATION IS A LEVER FOR ENGLISH LEARNER ACHIEVEMENT

Research points to the potential of science to increase students' academic performance in reading, writing, and science simultaneously.¹² In part, this is the result of weaving together language development skills with engaging science content. Instruction aligned to the performance expectations of the CA NGSS and CA ELD standards can provide English learner students with rigorous science learning when teachers scaffold lessons to encourage their participation. It can also change teacher perceptions of what ELs can do.

Research studies show that:

- Engaging science investigations can provide students with language practice and opportunities to develop academic vocabulary skills and make meaning from using evidence and interpreting scientific data. Inquiry-based science activities using collaborative peer-talk increase student motivation to use new language.¹³
- Science and engineering lessons motivate students to access prior knowledge, engage in problem solving, and develop new language skills simultaneously.
- Many key science vocabulary words are Spanish cognates, making the language more accessible to the majority of ELs who are Spanish speaking.¹⁴
- Scientific and engineering data are often presented in visual diagrams, graphs, charts, tables, and equations, providing opportunities for ELs to engage with

information in different ways to build conceptual understanding using evidence.

- Projects integrating ELD and science instruction in a sample of elementary schools raised teachers' expectations of what they believed their EL students could learn and produce.

As English language development researchers note, "Students do not need to wait until they learn English in order to engage in scientific thinking and complex scientific content."¹⁵

A NEW DIRECTION FOR TEACHING SCIENCE TO ENGLISH LEARNERS

Simultaneously implementing four new sets of standards — CCSS-Math, CCSS-English Language Arts, CA ELD Standards, and CA NGSS — is a Herculean task. That they are meant to be integrated makes it even tougher. Indeed, for effective integration of English language development and science education to take hold, teachers need:

- Curriculum aligned to the CA NGSS and CAELD standards;
- Instructional materials that provide coherence in approach and training to use those materials with English learners;
- Time for collaboration among teachers with science content expertise and teachers with English language instruction expertise;
- Professional learning, including both instructional strategies and content; and
- Standards-aligned, performance-based assessments that provide EL students the opportunities to demonstrate what they know.

State leaders could do a lot more to support teachers' transition to the new standards.

AS ENGLISH LANGUAGE DEVELOPMENT RESEARCHERS NOTE, "STUDENTS DO NOT NEED TO WAIT UNTIL THEY LEARN ENGLISH IN ORDER TO ENGAGE IN SCIENTIFIC THINKING AND COMPLEX SCIENTIFIC CONTENT."

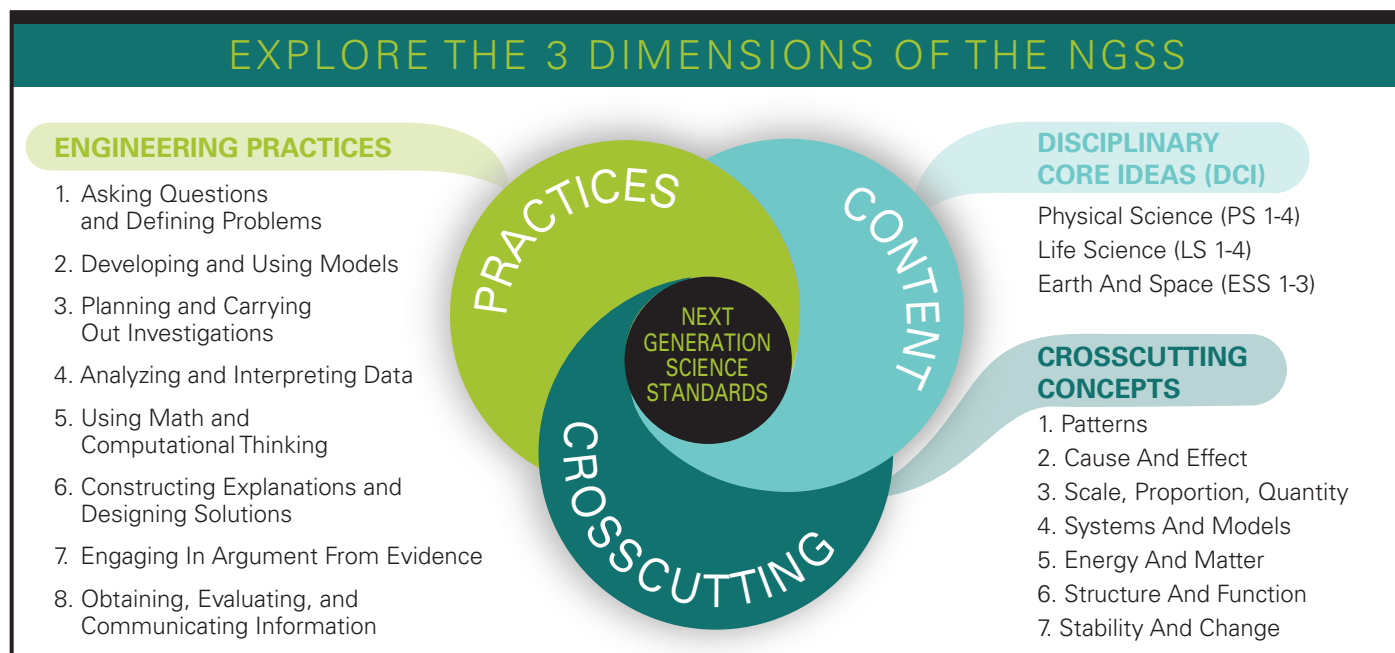
The new approach of CA NGSS has many advantages for ELs. The three dimensions of CA NGSS (see Figure 2) – scientific and engineering practices, disciplinary core content ideas and crosscutting concepts – can bring California science education up to speed with significant advancements in science, preparing students for the modern workforce if implemented with fidelity. California adopted CA NGSS in September of 2013 and the California Science Framework was recently approved in 2016. CA NGSS includes fewer disciplinary core ideas than previous science standards, in order to provide more time for teachers and students to develop deeper understanding of those scientific ideas. NGSS places greater emphasis science and engineering practices that involve language, such as arguing from evidence, and communicating information, which supports academic language development for ELs. With a new emphasis on engineering in CA NGSS, activities may involve developing drawings, constructing prototypes, and engaging in problem solving, which also support EL access to science learning. Additionally, NGSS crosscutting concepts are scientific ideas that ask students to make connections across different science topics as well as to other subject areas by finding patterns, identifying cause and effect, stability and change. These connections reinforce the relevance of science in students’ everyday lives. The CA Science

ADDITIONALLY, NGSS CROSSCUTTING CONCEPTS ARE SCIENTIFIC IDEAS THAT ASK STUDENTS TO MAKE CONNECTIONS ACROSS DIFFERENT SCIENCE TOPICS AS WELL AS TO OTHER SUBJECT AREAS BY FINDING PATTERNS, IDENTIFYING CAUSE AND EFFECT, STABILITY AND CHANGE.

Framework serves as a guide for how science materials should be developed by providers, reviewed by districts for CA NGSS alignment, and implemented for instruction by teachers. While some districts are already developing CA NGSS-aligned materials, most have not yet purchased them. CA NGSS-aligned state assessments will not roll out until the 2018-19 school year, and leadership is just beginning to address the redesign of high school science courses or teacher credentialing to align with CA NGSS.

Nevertheless, a number of California districts are ahead of the curve, adopting promising practices that weave ELD strategies with science education in order to provide high-quality learning for EL students. In this report, we highlight six of these districts. Together, they give us some examples of what is possible.

FIGURE 2: The Three Dimensions of NGSS



METHODOLOGY FOR SELECTING DISTRICTS

In search of districts that might have promising practices to share, we reviewed quantitative data to identify which districts serve more than the state average of English learners and students qualifying for free and/or reduced-price meals and whose English learners also scored higher than the state average for English learners on the 2015 Science CST.¹⁶ This narrowed the pool of potential districts to a dozen that we wanted to further investigate.

We also spoke with more than 20 experts in the field, including both science and English language development experts. We asked them to recommend districts engaged in innovative initiatives to advance science learning for EL students. Our interviews with experts also gave us insights into noteworthy instructional practices that help English learners access science. The experts came from WestEd's K-12 Alliance, the Learning Design Group at the Lawrence Hall of Science, CSU Long Beach, the University of San Francisco, Loyola Marymount University's Project STELLAR, Stanford University's Understanding Language center, the Exploratorium, and the Monterey Bay Aquarium, among others.

The data review and expert interviews yielded 12 districts and one charter management organization meriting further investigation. After conducting informational interviews with department directors and instructional specialists at each district, we selected a diverse set of six districts to visit in person:

CALIPATRIA UNIFIED SCHOOL DISTRICT (CUSD)

in rural Imperial County serves 1,144 students in four schools. Nine out of 10 students are Latino, and more than a third (37%) are English learners. The majority of ELs in Calipatria are second-generation, dual-language speakers who are fluent in Spanish and possess varying levels of English fluency. EL students in CUSD have a graduation rate of 83 percent on par with the district rate of 85 percent. In CUSD, 68 percent of eighth-grade EL students scored proficient on the 2015 Science CST, above the state EL average of 20 percent scoring proficient.

IMPERIAL UNIFIED SCHOOL DISTRICT (IUSD)

serves 4,000 students in five schools in rural Southern California. Four out of five students are Latino, and 23 percent are English learners, nearly all of them Spanish speakers. EL students have a 96 percent graduation rate in this district, and 33 percent of eighth-grade EL students scored proficient on the 2015 Science CST above the state EL average of 20 percent scoring proficient. In 2015 Reclassified Fluent English Proficient (R-FEP) eighth-grade students outpaced their peers with 80 percent of RFEPs scoring proficient on the Science CST compared with 60 percent of English only students.

OAK GROVE SCHOOL DISTRICT (OGSD)

serves 10,632 students in 22 schools in San Jose. ELs make up 29 percent of the student population. Two-thirds of ELs in Oak Grove speak Spanish, while the other third consists of students who speak one of 46 languages. EL achievement slightly outpaces the state's 19 percent average, with 22 percent of fifth-grade ELs scoring proficient on the Science CST in 2015.

OAKLAND UNIFIED SCHOOL DISTRICT (OUSD)

educates 49,098 preK-12 students in 118 schools. In OUSD, 31 percent of students are ELs, with more than 50 languages spoken at home.¹⁷ In 2014-15, only 51 percent of ELs were graduating — below the district rate of 63 percent for all students, with 31 percent of ELs dropping out.¹⁸ In 2014, Oakland experienced a 122 percent increase in the number of newcomer students since 2012, including refugee students and unaccompanied minors, many fleeing violence abroad.¹⁹

SAN FRANCISCO UNIFIED SCHOOL DISTRICT (SFUSD)

serves 58,865 students in pre-K through grade 12 in 120 schools. Twenty-seven percent of these students are ELs and speak 48 languages at home, with Spanish (48 percent) and Chinese (28 percent) the most common languages. EL achievement is above the state's 19 percent average with 25 percent of fifth-grade ELs scoring proficient on the Science CST in 2015.

WESTMINSTER SCHOOL DISTRICT (WSD)

in Orange County serves 9,401 students in kindergarten through eighth grade in 17 schools. Nearly half of the students are English language learners (47 percent), and the EL population is evenly split between Vietnamese and Spanish speakers. EL student achievement on the 2015 Science CST outperformed state averages with 57 percent of fifth-graders achieving proficiency compared with the state average of 19 percent, and 45 percent of EL eighth-graders scored proficient compared with the EL state average of 20 percent. In 2015, the White House Initiative for Educational Excellence for Hispanics honored the district as a Bright Spot for their work in increasing achievement for English learners.

While it is still early in implementation of the CA NGSS and CA ELD standards, we found that these districts share several effective strategies for advancing science learning for ELs. They include:

- 1 Providing high-quality, job-embedded professional learning for teachers and administrators to build science content knowledge and integrate science instruction with research-backed ELD instructional strategies;**
- 2 Partnering with science institutions;**
- 3 Systematically increasing science instructional time in the early grades for EL students;**
- 4 Encouraging innovative, multilingual strategies to advance science learning for ELs;**
- 5 Using LCAP budgeting to dedicate funding to promote equity and advance science instruction for English learners.**

The following discussion will highlight these practices, illustrated with examples from the six districts we visited that serve robust populations of EL students.

- 1 Providing high-quality, job-embedded professional learning for teachers and administrators to build science content knowledge and integrate science instruction with research-backed ELD instructional strategies.**

Schools and districts with the best outcomes for English learners in all subjects offer teachers job-

embedded professional learning that addresses their students' needs through every professional learning topic.²⁰ In these schools and districts, it is clear that students benefit from their teachers having a shared language and common learning goals related to language acquisition.¹⁹ As districts and schools confront the need for sophisticated instruction in science to meet the demands of the new standards, an increased commitment to professional learning is needed.

In the Calipatria Unified School District, all teachers are trained in language acquisition strategies and weave language learning and academic vocabulary building across all subjects, including science. The result is engaging lessons that advance content learning with language development. Middle school students take science, technology, engineering, and math (STEM) courses, studying in groups that teachers strategically organize to include students with different levels of English proficiency. Teachers encourage students to help each other and support their language development. CUSD has invested significant time and resources to develop the knowledge and skills of its teachers and school leaders, with particular emphasis on instructional shifts relevant to English learners in both content standards and CA ELD standards. In CUSD, high expectations for teachers aligns with high expectations for EL students: all high school students are encouraged to take two to three years of science courses in high school to meet the science course requirements to qualify for admission to California's four-year public universities, and students enrolled in the district's migrant students summer program engage in learning with a science focus.

Oakland Unified School District has made enormous strides to prepare teachers to provide science learning for ELs in just the past year. In response to data showing that teachers lacked the experience and support they needed to effectively reach English learners, in 2015 OUSD developed a district wide "Roadmap to English Language Learner Achievement." This plan aims to integrate CA ELD in all content areas and build the capacity of teachers — through ongoing professional learning — to provide instruction for ELs that meets the criteria of both the CA ELD and CA NGSS standards. In OUSD two specific efforts stand out.



Oakland Language Immersion Advancement in

Science: OLAS is a partnership between instructional leadership teams at five dual-language elementary schools, the OUSD Science Department, the OUSD English Language Learner and Multilingual Achievement Office, and outside partners such as UC Berkeley's Principal Leadership Institute (PLI), Multicultural Urban Secondary English Program (MUSE), Museum of Paleontology, and Bay Area Writing Project. These partners work together to integrate science learning with language instruction. During a weeklong OLAS summer institute, teams of five teachers and the site principal from each school strengthen their skills in pedagogy, instructional leadership, and equity. The training includes how teachers can help students access prior knowledge, develop academic language, and engage in oral language practice during science lessons. The educators learn to integrate science into their literacy lessons, preparing to engage students in academic conversations with peers and assigning students to record their scientific thinking in notebooks. During the institute, school teams also construct plans for the implementation of CA NGSS and language development at their schools. Following the institute, participating schools receive 12 hours of coaching and facilitation support throughout the school year to ensure job-embedded learning for teachers at the site.

Professional Learning Communities (PLC): In addition to the OLAS initiative, OUSD middle school teachers representing a cross section of schools participate in professional learning communities to share best practices. At a culminating PLC, teachers display student artifacts and instructional resources for a variety of CA NGSS-related skills, including academic conversations and graphic note-taking with science demonstrations. This teacher-led professional learning model is central



to changing science education. One science specialist shared observations on the shift to CA NGSS: "It's been tough to shift to hands-on science instruction. Teachers are helping each other see ways to make deeper connections to literacy and language development." The hope is that job-embedded professional learning will boost teachers' ability to support ELs in learning science.

Experts such as Kathy DiRanna, WestEd's K-12 Alliance Statewide Director, explained that needs for elementary and secondary teachers are different: more training will be needed to equip secondary science teachers with ELD instructional strategies, whereas at the elementary school level, teachers need more training in the science content.

2 Partnering with science institutions.

With the new CA NGSS standards, teachers need training in both science content and effective scientific teaching practices. Several districts have developed meaningful partnerships with science institutions to deepen and accelerate their efforts to provide high-quality science for their English learners. To bring teachers up to speed on the cutting-edge science concepts in CA NGSS and increase their confidence to provide science learning, science educational institutions can provide in-person and virtual professional learning opportunities. These institutions are uniquely positioned to provide guidance and curricular resources to guide teachers on using scientific content, the three dimensions of CA NGSS, and research-based instructional strategies in their lesson planning.

Some partnerships focus on strengthening science instruction and CA NGSS implementation specifically. Twelve districts, including OUSD, partner with the Lawrence Hall of Science at UC Berkeley in the BaySci

EDUCATORS (IN OUSD) LEARN TO INTEGRATE SCIENCE INTO THEIR LITERACY LESSONS, PREPARING TO ENGAGE STUDENTS IN ACADEMIC CONVERSATIONS WITH PEERS AND ASSIGNING STUDENTS TO RECORD THEIR SCIENTIFIC THINKING IN NOTEBOOKS.

program. BaySci works with San Francisco Bay Area school districts to strengthen the quality and amount of science instruction they provide. A partnership with the Lawrence Hall of Science, the Exploratorium, and Inverness Research, BaySci network provides district leadership seminars, a teacher leadership academy summer institute, and master group planning meetings. An evaluation conducted by SRI International in 2014 reported increases in the quality and duration of science instruction and student engagement in the majority of participating districts.²¹

Even districts physically far from science institutions can leverage partnership opportunities. For example, Calipatria's partnership with Research and Education Cooperative Occultation Network gives high school students access to an astronomer's telescope to make planetary observations and conduct astronomy research; the Astronomy Club students videotape observations from the telescope and send the recordings to university partners in St. Louis and Arizona.

The San Francisco Unified School District partners with the Exploratorium to provide teachers with ongoing training to use science as a catalyst for language acquisition and integrate science with ELD instruction. The Exploratorium science museum in San Francisco provides a specific focus on preparing teachers to use CA NGSS-aligned science instruction for ELD learning. Specifically in 2015, Science as A Spark For Language Learning (SPARK) launched at Marshall Elementary, a Spanish immersion school of 256 students with 63 percent English learners. Developed for schools serving 50 percent or more ELs, SPARK includes a four-day summer institute, professional learning sessions throughout the academic year, and weekly coaching from a science specialist. Additionally, it provides technology and science materials and paid planning time for teachers.

TEACHERS USE A COMBINATION OF APPROACHES, INCLUDING SCIENTIFIC AND ENGINEERING PRACTICES AND "SCIENCE TALK," TO HELP STUDENTS DEVELOP LANGUAGE AND SCIENTIFIC UNDERSTANDING SIMULTANEOUSLY.



Teachers use a combination of approaches, including scientific and engineering practices and “science talk,” to help students develop language and scientific understanding simultaneously. To support designated ELD goals, procedural, conceptual vocabulary and language functions are introduced in the lessons. This helps ELs to develop the language skills required to communicate about the content, and to practice and apply their new understandings to science investigations. During professional learning, teachers learn about scientific practices, science vocabulary instruction, language functions, investigation planning, and science talk norms — what Lynn Rankin, director of the Exploratorium's Institute for Inquiry, calls “into and from science” lessons. Teachers develop skills and ideas to connect ELD lessons to meaningful science investigation and make the shifts in content and instructional approaches that the CA NGSS standards demand.

3 Systematically increasing science instructional time in the early grades for English learners.

Science has long been shortchanged in elementary school classrooms. Although 95 percent of elementary school teachers think that science should be offered beginning in early grades (K-2), 92 percent of the responding elementary teachers stated they had only limited time for science.²² Clearly, that needs to change.

Oak Grove School District leaders have made a commitment to increasing instructional time in science and improving the quality of instruction for young ELs. In 2008, the Sobrato Early Academic Language (SEAL) program was piloted in Redwood City School District and San Jose Unified School District. In 2013, OGSD began SEAL implementation and by 2015, 14 OGSD

schools were in various stages of implementation.²³ Developed by English language learner expert Laurie Olsen, SEAL is a comprehensive language and literacy model designed to support the needs of pre-K through third-grade learners in English and Spanish.²⁴ The SEAL program centers on rigorous academic home language and English language development through the study of science and social studies thematic units that infuse the best practices for EL learning. Instruction provides multiple opportunities for students to use language with an emphasis on building both content understanding and use of complex academic language. An external evaluation shows that by the end of second grade, two-thirds of SEAL students closed language and literacy gaps compared with peers and scored higher in ELA and math than similar students in English-only programs.²⁵

In SEAL classrooms, a variety of research-based strategies are used to engage students in activities to promote oral and academic language with science learning. Each classroom becomes a supportive, language-rich environment with multiple opportunities to develop language. Structured oral language development takes the form of interactive read-alouds, think-pair-share activities, small group discussion, dramatic play, and story retelling. The learning environment reflects the model's focus on academic language with graphic organizers, photos, picture cues, and student work on full display. With science as the focus, students often work in table groups to conduct observations and experiments and record findings in notebooks following group discussions. Students use scientific tools and everyday objects to support science learning and academic language development.

The SEAL approach marks an important shift in providing CA NGSS-aligned science education by infusing research-based instructional strategies that are most effective for young EL students. To prepare teachers, SEAL requires extensive professional learning days over two years and coaching support for teachers to hone their practice. Teachers collaborate between classrooms and grade levels in order to vertically and horizontally align curriculum and instruction. There is an emphasis on developing programmatic and instructional coherence and encouraging teachers to collaborate across Spanish and English instruction. The thematic units integrate strategies purposefully incorporating the CA ELD, CCSS ELA, and CA NGSS

standards. Parent engagement modules and weekly family literacy activities in the classroom and at home have led to positive outcomes. SEAL families are more likely to engage in literacy-related activities than a national sample of Latino parents and as likely as college-educated parents.²⁶ Early elementary classrooms serving EL students have not historically provided significant exposure to science instruction for a variety of reasons. SEAL is changing that by expanding to serve young learners in 16 districts across California.²⁷

The SPARK program in San Francisco, discussed previously, has resulted in an increase in science instructional time. At Marshall Elementary School, teachers reported an increase from 1½ days each week during the 2014-15 school year teaching science to an average of three days per week a year later. With the increased time for science instruction, teachers felt that students gained a better understanding of scientific concepts and concurrently developed their academic language skills, according to Sarah Delaney, district science supervisor. As one teacher noted: "This is a breakthrough because the kids are getting the language they need and they're also getting the science they should have. I'm very grateful for the program because I don't have to hide my science. I can just teach more than an hour if I want to because... I'm teaching ELD too." A key component of SPARK is engaging in schoolwide conversations about the importance of increasing the amount of instructional minutes for science and supporting language development through science learning. Many teachers were initially concerned that adding science instruction would take away from





instructional time in other areas. But by integrating science and ELD instruction, teachers found that “they were able to teach more science, while still supporting their students’ English language learning.”²⁸

4 Encouraging innovative, multilingual strategies to advance science learning for English learners.

Research shows that multilingual strategies work. Even so, more innovation is needed to expand these practices and connect them to science education. Recent studies found that English learners in dual-language classes caught up to their English learner peers in English-only instruction on ELA assessments by fifth grade, outperformed them by seventh grade and throughout high school,²⁹ and were more likely to be reclassified as fluent English proficient.³⁰ Likewise, a recent evaluation of Project GLAD (Guided Language Acquisition Design) provides important evidence of the impact of sheltered instruction on fifth-grade EL achievement.³¹ The recent passage of Prop. 58 will also provide school districts with greater autonomy and opportunities to implement high-quality multilingual or biliteracy programs.

The Calipatria Unified School District has focused on recruiting local teachers with bilingual teaching credentials and who are multilingual, so that they can effectively communicate with students and families.

In Westminster School District, the district recently opened California’s first Vietnamese dual-language program. The program is well-attended by both Spanish and English-speaking students. In 2016-17, the district plans to launch a Spanish dual language immersion program starting with pre-K and kindergarten. To further support language acquisition while honoring all heritage languages, the district partnered with the Orange County Department of Education to offer the Pathways to Biliteracy program at pre-K, kindergarten, third, fifth/sixth, and eighth grades. Students can also earn the Seal of Biliteracy in high school, giving them a competitive advantage for college admission, scholarships, and careers.

WSD has taken up the challenge to use research-based practices to encourage innovation. All district teachers are trained in CA ELD standards and GLAD strategies to provide a solid foundation for supporting EL students and integrating ELD instructional approaches into all subject areas. Renae Bryant, executive director of the Office of Language Acquisition commented: “English language development is no longer the sole responsibility of the English language arts teacher. English language development must be context and content-rich and facilitated in every content area by every teacher.”

In the third-grade classrooms, innovative student focused instruction integrates ELD best practices with science learning as students rotate through stations in groups of five, learning about states of matter through group discussion, written activities, scientific experiment activities, and a technology research station. Each station provides academic language practice using visual materials, infusing science learning with best practices for EL instruction at every table. Teacher Rochelle Farley commented on the impact of changing her teaching: “I’m noticing a shift in the way that the kids are collaborating... making more observations themselves instead of being told something. It’s more investigative doing an experiment first and then deciding what that showed instead of top-down instruction where the teacher tells what we are going to experiment about.” Teacher Wendy Sorce said, “There really is a growth mindset on how we learn and what risks we’re willing to take. You have to let your kids do.” Their classrooms provide a safe space for students to experiment, take risks, and collaborate to problem solve.

Alongside neighboring districts, WSD participates in the ScienceWorks initiative, which provides a science coordinator at the elementary level. Every teacher in the district receives ScienceWorks training and science kits with lab materials. Denis Cruz, executive director of teaching and learning for the district, commented: “Every EL student receives hands-on inquiry science, and they conceptually can understand what we’re doing. It’s not just talking, and it’s not just in the book.”

In Imperial Unified School District, the district offers science explorations for second, third, and fourth-graders. High school students who are enrolled in the High School Explainers program as a science elective course facilitate these labs, guiding elementary school students through scientific and engineering experiments on topics ranging from erosion to wind energy to the solar system. The high school students create science and engineering demonstrations and practice problem-solving lessons during their elective class held in the makerspace lab set up with tools for engineering projects. They move back and forth between Spanish and English in order to engage the students. Teachers say the program is effective. “The high school students make the science accessible whether you speak English or not, and it does wonderful things for the high school students as well,” one teacher said.

Innovation is at the heart of IUSD’s effort to advance science for ELs in partnership with the San Diego Science Project’s CREATE STEM Success Initiative. Not only do teachers engage in advanced science professional learning trainings with the Imperial Valley Regional Occupation Program, but the district has transformed science learning through the Imperial Valley Discovery Zone, a “pop-up science center” in which a team of eight K-12 teachers across grade levels and subject areas collaborate to develop a series of CA NGSS-aligned lessons and train 145 high school students to facilitate problem-solving science activities for elementary school students. The result is community-wide excitement about science learning.

During eight full-day science instructional days, second, third and fourth-grade students rotate through five classrooms where 145 high school students wearing lab coats facilitate science experiments on topics ranging from erosion to wind energy to the solar system. The high school students create science and engineering demonstrations and practice problem-solving lessons during their elective class held in the makerspace lab.

Founding high school teachers and brothers Dan Gibbs and Dennis Gibbs explain their approach: “We try to build an experience, not a lesson. It’s going to be something the kids will remember and something that their classroom teacher could not do in the classroom either because of expertise in their particular area or because of time. Science is effective for our English learners, and they are drawn to it for so many reasons — the experiential hands-on learning and the curiosity is universal. It’s high engagement because it’s concrete and you can really put your hands on it and be thoughtful about it.”

The elementary EL students are supported to engage in the science lessons. A high school student explained, “One kid, he didn’t speak English very well, so I made sure to talk to him and go over the whole thing while

“I’M NOTICING A SHIFT IN THE WAY THAT THE KIDS ARE COLLABORATING...MAKING MORE OBSERVATIONS THEMSELVES INSTEAD OF BEING TOLD SOMETHING.”

– Wendy Sorce, Teacher

speaking Spanish. You could see he was excited. He was shy about not being able to speak English as well, but he was engaged.” To prepare the second-grade students for these full-day science investigations, elementary teachers front-load vocabulary about scientific concepts.

Teachers use collaborative lesson planning time to tackle challenging scientific concepts. One teacher commented, “I think working through the lessons together as a curriculum group helps because it gives you a model for developing an argument, using evidence, formulating a model, and vocalizing what that model might be.” After teachers have engaged in the process themselves, they are better positioned to provide students with the opportunities that CA NGSS promotes—to derive meaning from scientific and engineering experiences, analyze and interpret data, and use evidence to define and solve problems.

Teachers find the program raises both student and teachers’ expectations for science education for English learners. “The high school students make the science accessible whether you speak English or not, and it does wonderful things for the high school students as well,” one teacher said. Students, both those doing the teaching and those receiving instruction, are highly engaged. The program has inspired high school students to take more rigorous science courses. Dennis Gibbs said that 35 percent of the 11th- and 12th-graders take one or two Advanced Placement science courses, including AP Chemistry and AP Physics. In addition, many students take science courses in chemistry, geology, and anatomy/physiology. As the high school students talk about their role as leaders, the excitement is palpable. One bilingual student remarked, “being in this class has reassured me that science is where I want to be.”

IN IMPERIAL UNIFIED SCHOOL DISTRICT, 35 PERCENT OF THE 11TH- AND 12TH-GRADERS TAKE ONE OR TWO ADVANCED PLACEMENT SCIENCE COURSES, INCLUDING AP CHEMISTRY AND AP PHYSICS. IN ADDITION, MANY STUDENTS TAKE SCIENCE COURSES IN CHEMISTRY, GEOLOGY, AND ANATOMY/PHYSIOLOGY.

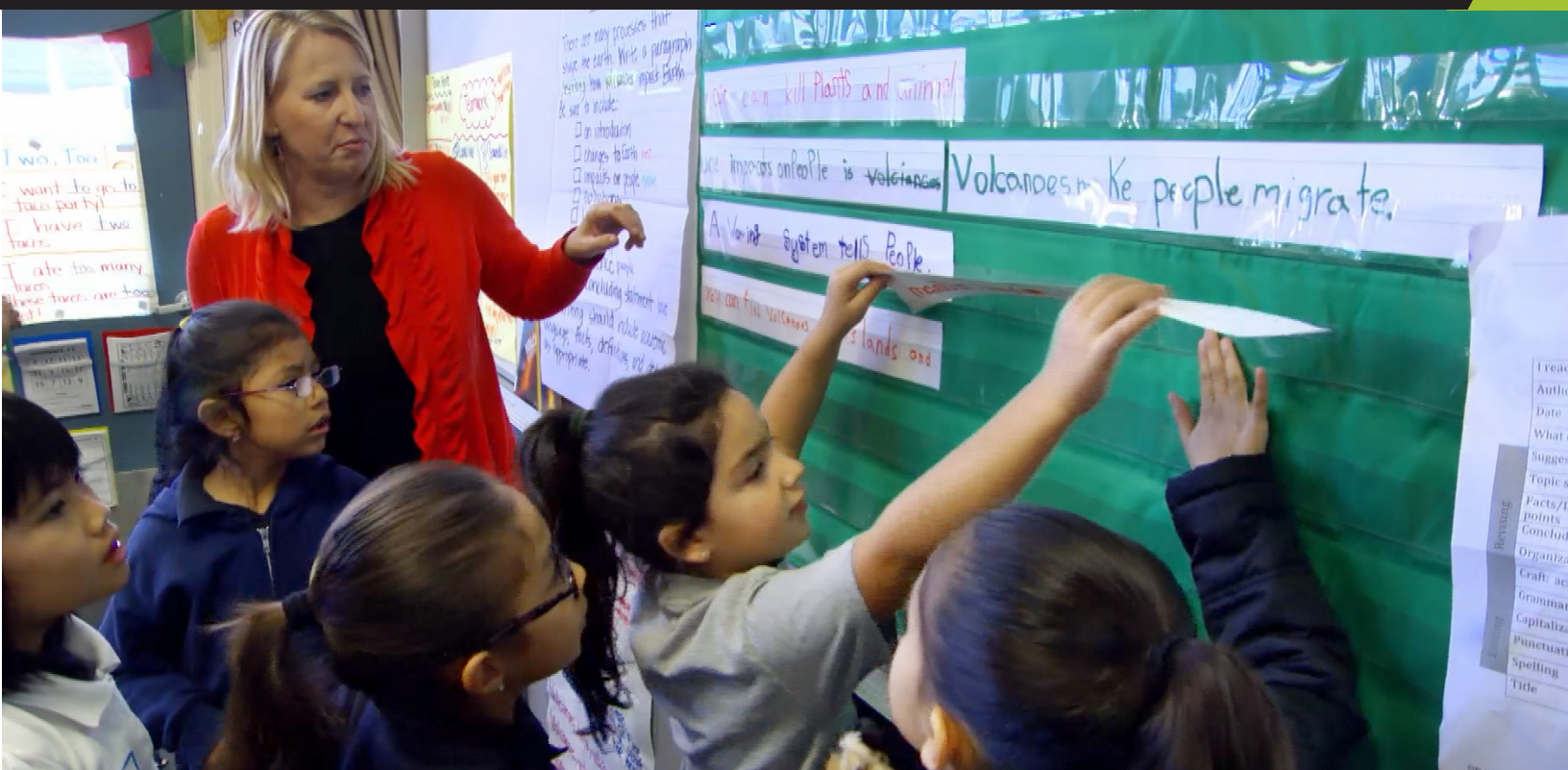
5 Using LCFF & LCAP budgeting to dedicate funding to promote equity and advance science instruction for English learners.

Funding structures in California can help advance science learning for ELs. With the shift in 2013 to the Local Control Funding Formula (LCFF), additional funding is allocated to districts for each EL student they serve. Districts are required to use this supplemental funding to “increase or improve services”³² for English learners, foster youth, homeless students, and low-income students, and they are required to report how they will spend that funding in their Local Control and Accountability Plans (LCAP).

Some districts used this opportunity strategically:

- IUSD used LCFF funds to hire an EL program assistant and to offer instructional strategies, including differentiated instruction for EL students in ELD and core content areas, academic vocabulary building, and oral language development.
- WSD’s LCAP includes investments in both science and ELs, including the design of grade-level units to integrate CA ELD standards with science using GLAD, thinking maps, Gifted and Talented Education (GATE) and Sheltered Instruction Observation Protocol (SIOP), and literacy skills for middle school science and social studies teachers.
- CUSD allocated LCFF funds to hire a part-time high school biology teacher and to provide professional learning for single-subject science teachers to incorporate ELD strategies. The district’s middle school principal refocused the academic content delivery across all grade levels and eliminated tracking students based on their status as English learners, special education students, or GATE students. The principal instituted a schoolwide daily science period and daily classroom visits to support teachers. At the high school, counselors promote a culture of college preparatory A-G coursework completion, encouraging all students to complete chemistry and take at least two years of science.

PERSISTENT CHALLENGES IN THE DISTRICTS



Our investigation surfaced not only noteworthy practices, but also substantial challenges. These challenges have implications for state policy and district implementation of integrated science education for English learners.

Funding has not been used for CA NGSS

implementation. Assembly Bill 86 allocated \$1.25 billion in funds from 2013 through 2015 for the implementation of state standards.³³ But of this total, we estimate that only 2.4 percent went to professional learning and instructional materials in science and only 2.2 percent to ELD. Effective implementation of CA ELD and CA NGSS will require fiscal support.

LCFF and LCAP are underutilized as levers for equity.

We noted three districts that made strategic LCAP investments in science for ELs. Unfortunately, these are the exceptions to the rule. A 2015 study by Education Trust–West found that only 27 out of 40 reviewed LCAPs mentioned CA NGSS, an increase of only three districts from 2014.³⁴ Another study of LCAPs noted that the plans in 2015 gave insufficient attention to the needs of English learners.³⁵ LCFF and the LCAP process have not yet achieved their potential as levers for equity.

Schools lack adequate curriculum and instructional materials.

Most schools do not yet have full sets of curriculum or instructional materials for CA NGSS-aligned science instruction and approach the change to CA NGSS one instructional unit at a time, with the burden falling on the individual teacher. Curriculum and instructional materials that integrate EL supports, such as Seeds of Science/Roots of Reading, which supports integrated instruction in grades 2 through 5, are not widely available. It is anticipated that districts will provide materials in 2018, but in the interim, teachers are making do with what they have.

Schools currently offer inadequate instructional time and coursework in science to master the expectations of CA NGSS.

Most districts are just beginning to plan for integrated implementation of CA NGSS and CA ELD, with front runners at the elementary school level due to participation in grant-funded consortiums such as BaySci or the K-12 Alliance. At the high school level, experts agree³⁶ that it will require more than two courses in science for students to master the standards contained in CA NGSS at the high school level, so the current state graduation requirement of two science courses is not sufficient.



High-need students need more access to A-G approved courses to ensure equity. ELs are generally under-enrolled in A-G college-preparatory coursework at California high schools overall so it is critical to ensure access for ELs to college-preparatory science courses.

Helen Quinn, Stanford University physics professor emerita and chair of the National Research Council committee that developed “A Framework for K-12 Science Education” in 2012 said that high school science coursework has traditionally been a sequence of biology, chemistry, and physics courses taught by science teachers who have credentials in those specific specialization areas. Implementation of CA NGSS will require districts to revise their science courses, making stronger connections across the disciplines and infusing engineering and earth sciences into other science courses. Or districts can choose to add stand-alone earth science courses, requiring more years of science study and finding teachers with the science content expertise to teach them. In addition, districts will need new and more interdisciplinary science courses approved as A-G lab courses by UCOP.

Schools will need support to implement the new performance-based assessments starting in 2018. Performance-based assessments can provide English learners with the opportunity to demonstrate what they know and apply scientific thinking, but most schools

are new to this approach and will need support to implement the CA NGSS assessments due to roll out in 2018. In focus groups at the districts we visited, teachers shared that they would like to see an CA NGSS assessment that includes both performance-based assessment activities and application of knowledge to real situations.

Staffing is a major hurdle for schools and districts. The call for a more interdisciplinary approach to science instruction in CA NGSS presents staffing challenges particularly at the secondary level because, as Calipatria Unified School District high school teacher Keitha McCandless explained, “As a single-subject science teacher, you may have your units in physical science, but then you can’t necessarily teach earth science.” Administrators in CUSD offer one solution: they rotate students so that the physical science teacher will teach physical science to all middle school students and not just the eighth-graders.

At the high school level, “the challenge is to attract teachers with the appropriate credentials to come to the district. In a community with a strong agricultural focus, science courses are in demand. Yet the agricultural science teacher is not credentialed as highly qualified, so those courses do not currently count towards A-G,” Ortiz explained. “A teacher may have the science content knowledge but not the teaching credential.” Ortiz likes to recruit homegrown teachers who share the firsthand experiences, needs, and strengths of their students and can offer powerful role models. In particular, ELs benefit from strong relationships with teachers who understand what it means to enter a school system that requires simultaneous second language acquisition and academic language learning.

PERFORMANCE-BASED ASSESSMENTS CAN PROVIDE ENGLISH LEARNERS WITH THE OPPORTUNITY TO DEMONSTRATE WHAT THEY KNOW AND APPLY SCIENTIFIC THINKING, BUT MOST SCHOOLS ARE NEW TO THIS APPROACH AND WILL NEED SUPPORT TO IMPLEMENT THE CA NGSS ASSESSMENTS.

DISTRICT RECOMMENDATIONS AND QUESTIONS FOR COMMUNITY STAKEHOLDERS TO ASK

Districts are just beginning to figure out how to weave together the implementation of the CA NGSS and CA ELD standards. Effective practices are still emerging. There is no one formula for effective science education for ELs, so districts need to do their own inquiry about how to best help their English learners achieve their potential as science learners. Here, we offer key recommendations for districts, and questions to guide districts and stakeholders to seek further understanding followed by a key action item. We follow this section with state level policy recommendations.

FUNDING: Use district LCFF investments and set LCAP goals to support science instruction with specific supports to increase opportunities for EL students.

- Are LCFF funds allocated to support CA NGSS-aligned science education for high-need students, including ELs?
- Does resource allocation advance equity for ELs?
For example, do schools with greater concentrations of EL students have greater access to science specialists who have training in ELD strategies?

KEY ACTION: Include resources, training and staffing for CA NGSS and CA ELD integration in district LCAP.

ACCESS TO RIGOROUS COURSEWORK: Ensure English learners are provided a rigorous science education, including equitable instructional time, courses that lead to A-G completion, and linguistic supports to excel in college preparatory coursework.

- Do EL students in elementary, middle, and high schools in the district have the same access to science instruction (coursework and time) and science specialists as other students, regardless of the school they attend?
- How is science content integrated into designated ELD-ELA time?
- Are EL students enrolled in high school science courses that are A-G approved?
- Are linguistic supports provided so that EL students are supported to excel in college preparatory science courses?
- To what extent do the college and career science courses ELs take include the CA NGSS standards, which include three dimensions: core ideas, scientific and engineering practices, and crosscutting concepts?

KEY ACTION: Provide access and support for EL students to succeed in a rich array of A-G approved CA NGSS science courses.

CURRICULUM RESOURCES: Provide high-quality science curriculum materials that are genuinely aligned to CA NGSS and vetted to support English language development.

- Has curriculum been selected and purchased to support CA NGSS implementation and language development for EL students? If not, what criteria will the district use to adopt instructional materials?
- Does the district use coherent, high-quality curriculum and provide training for teachers to use this curriculum to integrate science and ELD instruction?

KEY ACTION: Select high-quality curriculum that integrates CA NGSS with ELD strategies.

FAMILY ENGAGEMENT: Engage families in the district process of implementing the ELD and science standards including implementation planning to expand multilingual learning opportunities.

- How does the district welcome families of English learners to learn about science and language development opportunities?
- Are families, particularly those of EL students, informed about the requirements for college preparatory science coursework and their students' progress toward A-G completion versus graduation requirements?
- How is the district providing increased multilingual learning opportunities with the newly passed Prop 58?

KEY ACTION: Ensure that families, particularly of EL students are welcomed and informed regarding standards implementation and access to multilingual learning opportunities.

PROFESSIONAL LEARNING AND BUILDING TEACHER CAPACITY: Invest in teacher capacity to support CA NGSS science learning for ELs and provide adequate time for high-quality professional learning for teachers and administrators.

- How much collaboration time are teachers provided with experts in ELD and science to engage in instructional planning?
- Does the district allocate funding to support the development of multilingual teachers' ability to teach science in students' home languages?
- Is professional learning focused to provide teachers and administrators with training on both the CA ELD and science standards to advance English language acquisition best practices using the three-dimensions of CA NGSS science?
- Does the district make an effort to attract and retain effective bilingual teachers and science teachers with significant EL teaching experience, drawing from local communities to maximize the likelihood of retention?

KEY ACTION: Invest in time for high quality CA ELD/CA NGSS science professional development for teachers and administrators.

PARTNERSHIPS: Develop district partnerships to support science education for EL students and training for teachers.

- Does the district partner with science institutions, universities, and businesses to train teachers and provide curriculum content to support CA NGSS science education and STEM career preparation for EL students?

KEY ACTION: Foster partnerships with science rich institutions to advance CA NGSS implementation.



THERE IS NO ONE FORMULA FOR EFFECTIVE SCIENCE EDUCATION FOR ELS, SO DISTRICTS NEED TO DO THEIR OWN INQUIRY ABOUT HOW TO BEST HELP THEIR ENGLISH LEARNERS ACHIEVE THEIR POTENTIAL AS SCIENCE LEARNERS.

STATE POLICY RECOMMENDATIONS

The state can advance science education and boost conditions for English learners to excel by doing the following:

1. STRENGTHEN TEACHER PREPARATION.

Preparation of science teachers needs to look radically different. This is particularly true at the high school level, which has traditionally siloed science education by biology, chemistry, and physics. The California Commission on Teacher Credentialing (CTC) should:

- a. Work swiftly to expedite the development of revised science teaching standards and science professional credentialing tests to ensure implementation of CA NGSS as early as possible; and
- b. Ensure that courses offered through teacher preparation programs, including those required for elementary teacher and administrator credentials, are updated to include preparation for the demands of CA NGSS and instructional strategies for the CA ELD standards.

2. MAKE SCIENCE CURRICULUM AND INSTRUCTIONAL MATERIALS BROADLY AVAILABLE.

Few schools have CA NGSS-aligned curriculum, even though educators need access to the best possible resources and materials for teaching CA NGSS. In addition, they need science materials that are integrated with CA ELD strategies. In the absence of state-approved resources, teachers often search online to find instructional materials or develop their own lessons.

These stop-gap solutions are not sufficient.

The California Department of Education (CDE) should:

- a. Disseminate a list of vetted, high-quality curriculum and instructional materials for integrated CA ELD/ CA NGSS science, including resources developed by science-rich institutions such as The Lawrence Hall of Science and The Exploratorium.
- b. More broadly disseminate the CA NGSS science curriculum framework, so that more educators have access to it; and
- c. Provide training on strategies for integrating the CA ELD standards with CA NGSS.

3. IMPROVE ASSESSMENT IN SCIENCE.

It is encouraging that the CDE is developing optional performance-based formative assessments designed to measure what students know and understand. In order to make these performance-based assessments more accessible, the CDE should develop a guide for teachers to use them, and it should also provide translations into key native languages to ensure EL access. The current plan also calls for performance tasks to be included in the summative CA NGSS assessments; these should be developed with supports for EL students in mind.

4. SUPPORT MULTILINGUAL/DUAL-LANGUAGE EDUCATION.

Dual-language proficiency is associated with improved academic outcomes overall, including more sustained academic growth. To promote multilingualism, the state can:

- a. Strengthen the bilingual teacher pipeline by providing funding to districts for teachers to get a bilingual credential (BCLAD); and
- b. Foster implementation of Prop. 58 by disseminating multilingual resources for science and other subject areas through the CDE's digital platform.

5. IMPROVE COLLEGE AND CAREER PREPARATION IN SCIENCE.

To meet the performance expectations of CA NGSS, students will need more rigorous science instruction and more time learning science. To get there, we need to reconsider our state graduation requirements and our expectations for rigorous, college-preparatory science coursework. Specifically, we recommend:

- a. When reviewing and approving science courses, the UC system must ensure that each course meaningfully prepares students for mastery of the CA NGSS standards. It is also important that high school teachers and instructional leaders design A-G approved courses that include the CA ELD standards.



- b. To advance CA NGSS implementation and EL achievement, state leaders should convene a meeting of district leaders with the UC and CSU regents to share approaches for developing curriculum and syllabi that meet A-G requirements and support EL college preparatory learning.
- c. Increase the current state graduation requirements in science to provide more opportunities for learning the performance expectations of CA NGSS.

6. ENSURE THAT STATE ACCOUNTABILITY SYSTEMS PROMOTE A FOCUS ON SCIENCE AND ENGLISH LEARNERS.

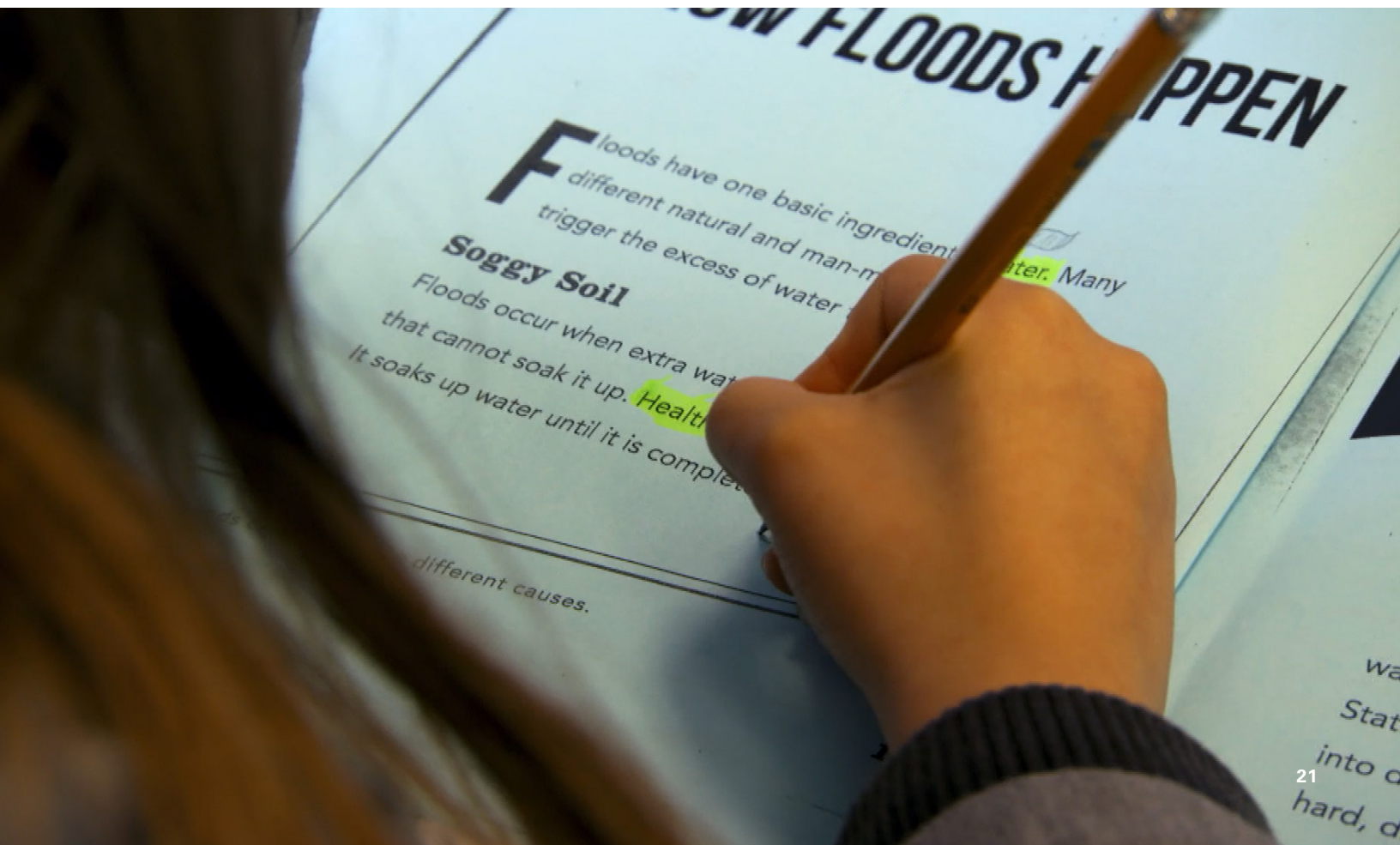
The California State Board of Education voted to include CA NGSS science assessment results, once available, in the “evaluation rubric,” the

dashboard that will serve as a centerpiece of the state’s new school accountability system. The SBE must follow through on this commitment as soon as results are available, starting in 2018-19, and it must use this data as part of its system of identifying schools and districts for support and assistance. When providing assistance to those identified schools and districts, county offices of education and the California Collaborative for Education Excellence should ensure that technical assistance experts have expertise on English learners’ needs and are attentive to CA NGSS and ELD implementation strategies.

CONCLUSION

The state's success in effectively educating its students demands increased attention to the needs of English learners, who make up more than a fifth of the state's students. Unfortunately, in the critical subject of science, English learners' access to rigorous learning opportunities lags behind their peers, a situation that can and must be addressed directly.

A handful of districts across California — from large urban districts in the Bay Area to small rural districts in Imperial County — are spearheading innovative approaches to boosting EL success in science. They are adopting forward-thinking instructional practices, developing teachers' capacity to integrate science with English language development, and finding creative partnerships to deepen science learning. These districts are prioritizing science learning and view the success of English learners as integral to their strategy. Examination of these approaches — using the questions in this report — has the potential to elevate the importance of science learning across the state. With the exciting opportunities presented by the new standards and our redesigned funding system, we are optimistic that more districts will view science as a powerful lever to advance learning and opportunity for California's English learners.



END NOTES

- 1 Zoe Ann Brown and Kathy DiRanna, "Equal Access to Content Instruction for English Learners, An Example from Science," (San Francisco, CA: WestEd, 2013).
- 2 In the 2015-16 school year, 1.37 million public school students in California were classified as English learners, representing 22 percent of the public school population. Source: California Department of Education Data Reporting Office, DataQuest, 2015-16 Enrollment by English Language Acquisition Status (ELAS) and Grade. <http://dq.cde.ca.gov/dataquest/longtermel/ELAS.aspx?cds=00&agglevel=State&year=2015-16>
- 3 Rena Dorph, Patrick M. Shields, Juliet Tiffany-Morales, Ardice Hartry, and Teresa McCaffrey, "High Hopes, Few Opportunities: The Status of Elementary Science Education in California." Center For The Future of Teaching and Learning, (San Francisco, CA: WestEd, 2011).
- 4 California Department of Education Data Reporting Office, DataQuest, 2015-16 Enrollment by English Language Acquisition Status (ELAS) and Grade.
- 5 United States Census Bureau, 2010 to 2014. <https://www.census.gov/>
- 6 California Department of Education, Dataquest, 2014-15.
- 7 U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics. "National Assessment of Educational Progress (NAEP), 2015 Science Assessments." <http://www.nationsreportcard.gov/>
- 8 California Department of Education, DataQuest, California Longitudinal Pupil Achievement Data System (CALPADS).
- 9 Susan Gomez-Zwiep and William J Straits, "Inquiry Science: The Gateway to English Language Proficiency." Journal of Science Teacher Education (2013), 24:1315-1331.
- 10 The Education Trust–West analysis of California Department of Education's 2014-15 Staff Assignment and Course Data. Retrieved November 2016. <http://www.cde.ca.gov/ds/sd/df/filesassign.asp>
- 11 The Education Trust–West analysis of California Department of Education's 2014-15 Staff Assignment and Course Data. Retrieved November 2016.
- 12 Brown, et al., "Equal Access to Content Instruction For English Learners," p.5.
- 13 Gomez-Zwiep et al., "Inquiry Science: The Gateway to English Language Proficiency."
- 14 Helen Quinn, Okhee Lee, and Guadalupe Valdes, "Language Demands and Opportunities in Relation to Next Generation Science Standards for English Language Learners: What Teachers Need to Know. Understanding Language." (Palo Alto, CA: Stanford University, 2013).
- 15 Gomez-Zwiep et al., "Inquiry Science: The Gateway to English Language Proficiency."
- 16 As of November 2016, the CST science assessment is currently the only ESEA-required science assessment used by school districts to test fifth-, eighth- and 10th-grade science learning proficiency. CA NGSS science assessments are in development and scheduled for statewide use in 2018-2019.
- 17 Oakland Unified School District, "OUSD Roadmap to ELL Achievement 2015-2018," p. 7.
- 18 California Department of Education, Data Reporting Office, "Cohort Outcomes Data for the Class of 2014-15," CALPADS data for Oakland Unified School District. <http://data1.cde.ca.gov/dataquest/CohortRates/>
- 19 "OUSD Roadmap to ELL Achievement 2015-2018," p. 8.
- 20 Carrie Hahnel, Leni Wolf, Amber Banks, and Jeannette LaFors, "The Language of Reform: English Learners in California's Shifting Education Landscape," The Education Trust–West, Sept. 23, 2014.
- 21 Julie Remold, Soren Rosier, Denise Sauerteig, Timothy Podkul, Ruchi Bhanot, and Vera Michalchik, SRI Education, "BaySci: A Partnership for Bay Area Science Education — August 2014 Evaluation Report."
- 22 Dorph et al., "High Hopes, Few Opportunities."
- 23 "Oak Grove School District Five Year Plan: 2015-2020." <http://www.ogsd.net/wp-content/uploads/2015/11/5-Year-Plan-2015-2020-Final-Approved.pdf>
- 24 "The Seal Model: Powerful Language Learning." http://www.laurieolsen.com/uploads/2/5/4/9/25499564/seal_a_prek-3_model_final.pdf
- 25 "The Seal Model: Powerful Language Learning."
- 26 "The Seal Model: Powerful Language Learning."
- 27 A full list of schools and districts can be found at: <http://www.sobrato.com/sobrato-philanthropies/sobrato-family-foundation/seal/current-sites-community-impact/>
- 28 Sarah Delaney, "Science as a Spark for Language Learning Final Report," San Francisco Unified School District, Dec. 22, 2015, p. 4.
- 29 Rachel A. Valentino and Sean F. Reardon, "Effectiveness of Four Instructional Programs Designed to Serve English Language Learners: Variation by Ethnicity and Initial English Proficiency." Educational Evaluation and Policy Analysis (2015), Vol. 37(4), pp. 612-637.
- 30 Ilana Umansky and Sean F. Reardon, "Reclassification Patterns among Latino English Learner Students in Bilingual, Dual Immersion, and English Immersion Classrooms," American Educational Research Journal (2014), Vol. 51, pp. 879-912.
- 31 Theresa Deussen, Angela Roccograndi, Makoto Hanita, Elizabeth Autio, and Claudia Rodriguez-Mojica. "The Impact of Project GLAD on Fifth-Grade Literacy: Sheltered Instruction and English Learners in the Mainstream Classroom." Presented at AERA April 2015 Chicago. (Portland, OR: Education Northwest, 2015).
- 32 Cal. Code Regs., tit. 5 § 15496.
- 33 California Department of Education, "Report to the Governor, the Legislature, and the Department of Finance: Local Educational Agency Expenditures of \$1.25 Billion in Common Core Implementation Funding Allocated for Fiscal Years 2012–13 and 2013–14" (December 2015) Retrieved from: <http://www.cde.ca.gov/fg/aa/ca/documents/commoncore15legreport.pdf>
- 34 "Puzzling Plans and Budgets: Making Sense of California's Second Year Local Control and Accountability Plans." (Oakland CA: The Education Trust–West, April 2016).
- 35 Laurie Olsen, Elvira Armas, Magaly Lavendenz, "A Review of Year 2 LCAPS: A Weak Response To English Learners." (Long Beach, CA: Californians Together, 2016).
- 36 Interviews with Sarah Delaney, science supervisor, San Francisco Unified School District, and Helen Quinn, physics professor emerita, Stanford University.

The following 2015 data were used to select schools and districts:

Grade Level	State Average EL Population	Percent of ELs Scoring Proficient on Science CST
5th grade	24 percent	19 percent
8th grade	14 percent	20 percent
10th grade	12 percent	10 percent

ENGLISH LEARNERS MAKE UP MORE THAN A FIFTH OF THE STATE'S STUDENTS. UNFORTUNATELY, IN THE CRITICAL SUBJECT OF SCIENCE, ENGLISH LEARNERS' ACCESS TO RIGOROUS LEARNING OPPORTUNITIES LAGS BEHIND THEIR PEERS. THIS SITUATION CAN AND MUST BE ADDRESSED DIRECTLY.

MAMMOTH SKELETON

Question.....

If this was found under what is water now.....

What would this fact tell us about the past?

Come over and figure it out.

Using STEM America by
III Local Entity Grant

ESQUELETO DE MAMUT

Pregunta...

Si este fuera encontrado debajo del agua en el presente... que explicaria del pasado?

Vengan y descubranlo!





OUR MISSION

The Education Trust-West works for the high academic achievement of all students at all levels, pre-K through college. We expose opportunity and achievement gaps that separate students of color and low-income students from other youth, and we identify and advocate for the strategies that will forever close those gaps.

ACKNOWLEDGMENTS

We offer our appreciation to the S.D. Bechtel, Jr. Foundation and the Bill & Melinda Gates Foundation for their generous support, which made this report possible. We also offer our gratitude to the many individuals who shared their expertise and perspectives with us as we developed this report.



The Education Trust—West

1814 Franklin Street, Suite 600 | Oakland, California 94612 | 510.465.6444

www.edtrustwest.org