

Strengthening Science Education and Environmental Literacy in California's New Era Of Local Control: The Toolkit

September 2016

Next Generation Science and Environmental Literacy in Local Planning: Making the Case

Talking Points and FAQs

Making the Case for Science Education

What is STEM education? It is appropriate for all students?

- High-quality science education encompasses both rigorous instruction in the discipline of science, with applications in engineering, and can be integrated with project-based learning approaches that weave science and other subjects together, along with building literacy within these domains – as they are in the real-world practice of science and engineering.
- While science education can equip students with sought-after technical skills and prepare them for high-demand careers in science research, engineering, and computer science fields, its purpose in K-12 schools is more fundamental. It is about providing every student with the opportunities and tools to become scientifically literate citizens able to navigate daily life, work and community in an increasingly technology-driven world.

What is the status of science education in California? And how does California compare nationally?

- California students' achievement in science trails that of students in most other U.S. states – ranking 46th in science on the most recent National Assessment of Educational Progressⁱ.
- Similarly, California students lag behind their peers in other countries, measuring below the international average on the Trends in International Math and Science Studies text, the benchmark international test of math and science.ⁱⁱ
- Over the past decade and a half, science education has been neglectedⁱⁱⁱ. Nationally, nearly four times as many instructional minutes are devoted to English Language Arts in elementary grades as compared to science^{iv} with the discrepancy growing since the introduction of No Child Left Behind. The average time spent per week on science instruction in California in 2008 was 1.8 hours compared to the national average of 2.3 hours per week.^v
- The biggest opportunity to truly change the science learning experience for all students in California lies in the successful implementation of the state's new science standards.



What are the Next Generation Science Standards?

- California adopted new state science standards in September 2013 based on the Next Generation Science Standards (NGSS). The NGSS were developed through a collaboration of 26 states. These new standards are a significant departure from the old standards and focus on “three-dimensional learning”. This means that students need to directly engage in the same science and engineering practices (Dimension 1) that scientists and engineers do as the primary means of understanding the most important disciplinary core ideas (Dimension 2). Students should also be provided with regular opportunities to apply their understanding to larger cross-cutting concepts (Dimension 3) that relate to all disciplines of science and engineering. In addition, for the first time, engineering design is fully integrated into science standards and practices such as modeling and simulation are more explicitly included.
- Following adoption of these new standards, the state is developing a new science curriculum framework and new tests aligned with the new standards, while significant resources are being devoted to prepare teachers to implement the NGSS in their classrooms.
- The NGSS are expected to be fully implemented in all schools in California by 2018-19.

How is Environmental Education related to the NGSS and why is this important for our students?

- The environment and the impacts of human activities on the health of the planet are an intrinsically engaging context for student learning across multiple science disciplines. In 2004, California approved a set of Environmental Principles and Concepts (EP&C's) that outline foundational content to be taught in grades K-12. These EP&C's are being integrated into the California NGSS offering schools an exciting opportunity to increase student interest in science and develop their environmental literacy.
- Employment of environmental scientists and specialists is projected to grow 15 percent from 2012 to 2022, faster than the average for all occupations.

Why is science and STEM so important to California and our students?

- Californians understand that our innovation economy is largely driven by STEM fields. As one example, a recent USC-Los Angeles Times poll found that nearly half of voters identified funding for K-12 STEM education as a top priority.^{vi}
- STEM jobs in California are projected to grow 22 percent by 2020 – to well over one million new jobs^{vii} -- and seven of the nation's ten fastest-growing occupations are in STEM fields^{viii}.
- Unemployment in STEM fields is low. In California, as in the nation as a whole, those in STEM occupations had significantly lower rates of unemployment (3.7 percent as compared to 9.2 percent for those in non-STEM fields).

Are there disparities in science in terms of access to or outcomes in science based on race, ethnicity and gender?

- Schools that serve our most disadvantaged students are likely to have fewer highly qualified science teachers, lack science lab facilities and offer fewer advanced courses. As a result, students attending these schools are graduating even further behind their more affluent peers meaning that they are less likely to be able to access higher education and more technologically advanced and higher-paying job opportunities.

- Large gaps exist in student performance based on race, ethnicity and income. For example, 41 percent of white students scored proficient or higher in 4th grade science on the most recent “Nation’s Report Card,” compared to only 9 percent of African American and 8 percent of Hispanic students.
- Women and girls are underrepresented in STEM fields, accounting for only about 40 percent of all STEM bachelor’s degrees awarded in California. In the fields of engineering and computer science, their numbers are far fewer, with only 14 percent of bachelor’s degrees awarded to women in Computer Science fields^{ix}.

Questions Related to Implementing the Science and NGSS

Why do we need to focus on implementing these new science standards now? Isn’t it still a long time before we are expected to be fully implementing them?

- The NGSS were adopted by California in September 2013. The statewide implementation plan adopted by the State Board of Education calls for schools to prepare for full implementation by the Fall of 2018. The three-dimensional design of the NGSS and the addition of engineering design and practices such as modeling and simulation will require significant resources and time to prepare for.
- The multi-year planning and funding that LCAPs encourage allows districts to thoughtfully plan for full implementation of the NGSS.

Can we begin implementing the new science standards before new tests are developed? What is happening with the old CST science test?

- The state is beginning to develop new state-administered standardized tests aligned to the NGSS. These tests are expected to be pilot tested in Spring 2017, field tested in Spring 2018, and fully administered in Spring 2019. The state administered and reported the results of the old CST test in Spring 2016 for science to meet federal compliance requirements (through Spring 2016). However, because the CST is not aligned with the NGSS, the results are not used for state accountability purposes. In meantime, schools can begin to use new formative assessments to guide instruction at the classroom level, such as those being developed through consortiums such as Council of Chief State School Officers and the Council of State Science Supervisors.

Do we need to wait for the state to approve new instructional materials aligned to the new standards?

- Districts no longer need to wait for the state to adopt curriculum frameworks or instructional materials to begin teaching the new science standards. Because the standards were developed in multi-state consortia, there are already some instructional materials available nationally and within California. For example, the Lawrence Hall of Science has reviewed and identified a set of materials that are aligned to the new standards^x. In addition, tools such as the EQUIP rubric from Achieve are available to help teachers and district administrators identify whether materials are NGSS-aligned.^{xi}

When will we get funds to support new standards implementation?

- In 2013, California adopted a major change in how schools are funded and held accountable -- the Local Control Funding Formula (LCFF). It was designed to provide base funding for each student and allocates supplemental funding for children who need additional support to succeed. This means that some districts are receiving more money, and all districts have more control and flexibility over how they can direct spending to serve their students' needs. With this new funding system, all districts can and must allocate their local budgets to meet the costs of implementing the new state standards.
- The state allocated funding of \$1.25 billion in FY14 and another \$3.5 billion is proposed for FY16 to jump-start implementation of the CCSS and NGSS. However, these funds were meant only to help cover the short-term transition costs of moving to a new system – such as training to introduce teachers to the new standards and purchasing technology and instructional materials. The ongoing costs of delivering core instruction must be embedded in each district's core budget and program plan.

Does the Local Control and Accountability Plan (LCAP) require schools to address science?

- State law requires that every LCAP address eight specific state priorities. Priority #2 Implementation of State Standards includes all State Board of Education approved standards, including the NGSS.^{xii}
- Important goals in science education could also be included under other priorities, such as Priority #1 (which addresses students having appropriately assigned and credentialed teachers), Priority #4 (which focuses on pupil achievement through performance on standardized tests and other indicators of college and career readiness), and Priority #3 (which requires students to be enrolled in a broad course of study).

See the *LCAP Primer* for more detailed information about the LCAP process.

How can we begin implementing new science standards while we are expected to be fully implementing new Common Core standards?

- California's new educational standards – the Common Core State Standards (CCSS) for math and English language arts (ELA) and Next Generation Science Standards (NGSS) – are philosophically and pedagogically convergent. Together, they fundamentally revise teaching and learning practices to focus on deepening students' conceptual understanding, critical thinking and communication skills and to promote literacy across all fields. This alignment in instructional approaches can be implemented across these efforts with the resulting improved coordination across professional learning activities benefitting teachers and students. In fact, the ELA standards are officially titled, "Common Core State Standards for English Language Arts and Literacy in History/Social Studies, Science and Other Technical Subjects". Implementing Common Core together with NGSS will make teachers' jobs easier and will bring unprecedented coherence to the curriculum.

How do the Next Generation Science Standards connect with Common Core and other subject areas?

- The Next Generation Science Standards were developed to align with major shifts in the Common Core State Standards and clearly identify the points of linkage to the new math and English language arts standards. This philosophical alignment among standards requires a range of pedagogical approaches to teaching science in an integrated (i.e., integrating life, earth & space, physical science and engineering) and interdisciplinary (i.e., integrating science with math and language arts) manner.
- As one example, literacy skills are critical to building knowledge in science: reading in science requires understanding the nature of evidence used, and the capacity to make and assess arguments, synthesize complex information, and follow detailed procedures and accounts of events and concepts. Similarly, writing and presenting information orally are key means for learners to assert and defend claims in science, demonstrate what they know about a concept, and convey what they have experienced, imagined, thought, and learned.
- NGSS also provide opportunities to connect with a broad range of other topics and fields, including engineering, computer science, environmental education, and the arts.
 - The new science standards include a significantly increased focus on engineering practices and the engineering design process, key foundational components of engineering education.
 - Similarly, for computer science, the NGSS includes the key practices of computational thinking and the use of modeling and simulation, skills that are foundational in computer science.
 - The NGSS support the development of students' abilities to address environmental issues and the development of environmental literacy by providing real world context for teaching and learning. Research demonstrates that environmental education is an effective mechanism for engaging students in real-world learning experiences that allow them to investigate scientific problems in their own communities, and develop their problem-solving skills by designing and implementing practical solutions to these problems.^{xiii}
 - Similarly, arts education provides a key connection to apply a number of real world applications envisioned in the NGSS.

ⁱ National Assessment Educational Progress (NAEP) report. Nation's Report Card, National Center for Education Statistics, <http://nces.ed.gov/nationsreportcard/>.

ⁱⁱ 2011 Trends in International Math and Science Studies (TIMSS). http://nces.ed.gov/timss/pdf/results11rev_California_Science.pdf.

ⁱⁱⁱ See LH/CFTL/SRI reports

^{iv} See <http://www.horizon-research.com/2012nssme/wp-content/uploads/2013/02/2012-NSSME-Full-Report-updated-11-13-13.pdf>

^v See Rolf K. Blank, "Science Instructional Time Is Declining in Elementary Schools: What Are the Implications for Student Achievement and Closing the Gap?" *Science Education*, October 2013

^{vi} USC Dornsife-LA Times Poll. See LA Times story as reported April 13, 2015 at <http://www.latimes.com/local/lanow/la-me-ln-technology-poll-20150410-story.html>

^{vii} Anthony P. Carnevale et al., "Projections of Jobs and Education Requirements Through 2020," Georgetown University Public Policy Institute, Center on Education and the Workforce, June 2013.

^{viii} Employment Projections Program, U.S. Department of Labor, U.S. Bureau of Labor Statistics, *Employment by Occupation*, BLS:2009. http://www.bls.gov/emp/ep_table_102.htm.

^{ix} See <http://www.cslnet.org/wp-content/uploads/2014/09/Computer-Science-Education-in-California-From-Kindergarten-to-the-Workforce.pdf>

^x See http://www.lawrencehallofscience.org/services_and_expertise/ngss/schools_and_districts

^{xi} See <http://www.nextgenscience.org/resources>.

^{xii} In November 2014, the State Board of Education provided further guidance that specifically clarified this issue for the field. See <http://www.cde.ca.gov/fg/aa/lc/lcffffaq.asp#LCAP>

^{xiii} Lieberman, Gerald A., "Education and the Environment: Creating Standards-Based Programs in Schools and Districts," Cambridge: Harvard Education Press, 2013.

Supporting Environmental Literacy via History-Social Science Learning: Making the Case

Talking Points and FAQs

Making the Case for Environmental Literacy

- In 2014, State Superintendent Tom Torlakson convened a task force to develop the *Blueprint for Environmental Literacy: Educating Every California Student In, About, and For the Environment*.
- The Blueprint is premised on the idea that California faces serious environmental challenges that affect everyone's well being, such as climate change, drought, and air quality, and that the only way to adequately address these issues, and prevent additional ones, is to have an environmentally literate population.
- The Blueprint calls for a more robust, accessible, and culturally relevant environmental education for all California students, infused throughout the curriculum, from science to history-social science.
- California's Environmental Principles and Concepts were approved by the State Board of Education in 2004. These principles and supporting concepts examine the interactions and interdependence of human societies and natural systems. The five principles include: People Depend on Natural Systems; People Influence Natural Systems; Natural Systems Change in Ways that People Benefit from and can Influence; There are no Permanent or Impermeable Boundaries that Prevent Matter from Flowing Between Systems; Decisions Affecting Resources and Natural Systems are Complex and Involve Many Factors.
- Environmental principles and concepts provide an important depth to HSS content for they help illuminate the role that natural resources, climate, and geography played in the structure of societies of the past, or their role in shaping economic and political realities today.
- Every student must experience formal and informal environmental education opportunities throughout the school year. In order to achieve this goal, school districts can build partnerships with and access support from history-social science experts and community leaders, such as historians, museums, state historic parks, historical societies, higher education institutions, and business and civic leadership in the community that can advocate for history-social science.

How is environmental literacy and learning supported in the history-social science classroom?

- Teaching environmental literacy means working to instill the knowledge, skills, and understanding of environmental principles and concepts to enable students to analyze environmental issues and make informed decisions. In order for students to become environmentally literate, they will need the information, as well as practice with the methods, that the history-social science fields provide. The subjects of history, geography, economics, and government impart important content material while training students in developing critical thinking skills, as well as practice in reading, writing, and speaking. Together, this knowledge and experience helps prepare students to take on the environmental challenges of their times.
- Meanwhile, environmental principles and concepts offer genuine benefits to history-social science instruction. Throughout the HSS Framework (adopted by the state of CA in July 2016), there are numerous examples of how environmental literacy shapes a well-rounded course of study. Environmental principles and concepts provide an important depth to HSS content. An environmental lens enhances the History, Government, Economics, Sociology, and Geography classrooms.



- Using environmental literacy as a frame, teachers can encourage students to explore the past through investigations on historically significant topics. In sixth grade, teachers can ask students a guiding question: “How did the environment influence human migration, ancient ways of life, and the development of societies?” Re-orienting each grade level around open-ended investigative questions encourages a new kind of instruction that does not align with the state’s prior emphasis on content memorization. The HSS Framework also names and describes excerpts from hundreds of age-appropriate primary sources, around which teachers are encouraged to construct lessons and can think deeply about how to engage students’ development of environmental literacy. Moreover, threaded throughout the HSS Framework are number of vignettes, or classroom examples that detail how a teacher works to impart content, literacy, skills, and citizenship in their daily instruction.
- History/social science instruction should be organized to encourage students to think critically about the environment as a category of analysis in understanding their past and present social circumstances. The HSS Framework includes examples from California’s Education and the Environment Initiative (EEI) units for history-social science, and is infused with the state-adopted Environmental Principles and Concepts.
- California adopted a new History-Social Science Framework in July 2016. The new Framework is a significant departure from the old content standards that tend to emphasize fact-based learning as opposed to learning through “doing history.” The new HSS Framework incorporates the state’s content standards, Common Core Standards, and English Language Arts/English Language Development Standards, while providing a new frame for effective HSS instruction. The four key instructional shifts that transform history-social science education in this document are a new emphasis on updated content, literacy, skills, and citizenship.

Questions related to implementing History-Social Science (HSS)

What is the status of history-social science education in California? And how does California compare nationally?

- California students’ achievement in history-social science trails that of students in most other U.S. states – ranking in the lowest ten performing states consistently over the past twenty years. According to the most recently available scores from the National Assessment of Educational Progress, only 18% of California’s 8th graders scored at a proficient level on history-social science national assessments.¹
- Over the past twenty years, history-social science education has been neglected. Mandates on instructional time for history-social science education have not existed. This has meant that especially at the elementary school level, many schools have abandoned HSS instruction altogether in favor of increasing time for English-Language Arts and Mathematics to meet the goals of No Child Left Behind (NCLB) and the Elementary and Secondary Education Act (also known as the Every Student Succeeds Act (ESSA)).
- The marginalization of HSS across the board is not a new development, but what is new is that there is an increasing recognition by researchers that HSS instruction is essential for both the content and the reading, writing, and thinking skills it imparts.² This recognition came in part with California’s 2010 decision to adopt the Common Core State Standards. The shifts in instructional practice required by the Common Core are substantial, particularly in the discipline of history, where for a generation teachers have focused their efforts on improving their students’ ability to master multiple-choice content-based tests on a broad spectrum of topics using outdated textbooks. To effectively incorporate content-area teachers in the shift to more substantive instruction, schools should emphasize disciplinary practices, such as the process of doing history – investigation, evidence, close reading, and

¹ NAEP, http://www.nationsreportcard.gov/hgc_2014/#home#overviews. Information from the CDE: <http://www.cde.ca.gov/ta/tg/nr/caresults.asp>. Information from Ed Source: <https://edsources.org/2013/california-students-among-worst-performers-on-national-assessment-of-reading-and-mah/41329>

² Intersegmental Committee of the Academic Senates of the California Community Colleges, the California State University, and the University of California, *Academic Literacy: A Statement of Competencies Expected of Students Entering California’s Public Colleges and Universities* (California, 2002). <http://www.asccc.org/Publications/Papers/AcademicLiteracy/AcademicLiteracy.pdf>.

argumentative writing – and they must provide the training and curricular resources that teachers will need to implement these shifts.

- The biggest opportunity to change history-social science learning for all students in California lies in the successful implementation of the state’s new History-Social Science Framework, including its instructional shifts and incorporation of Environmental Principles and Concepts.

Why do we need to focus on implementing the new HSS Framework now?

- The HSS Framework was adopted in July 2016. The statewide implementation plan adopted by the State Board of Education calls for schools to prepare for full implementation, including instructional materials. For a complete timeline of the CDE’s plans for adoptions, visit this website: <http://www.cde.ca.gov/ci/hs/im/hissocs2017sigevents.asp>. The instructional shifts recommended by the new Framework will require significant resources and training to prepare teachers for implementation.

Can we begin implementing the new HSS Framework before new tests are developed? What is happening with the old CST history-social science test?

- The state has not developed standardized tests aligned to the HSS Framework. The CST was discontinued and is no longer being administered to assess statewide HSS education. The CAASPP (in particular the SBAC ELA assessment) contains a small literacy in history-social science portion, but does not assess content knowledge. In the temporary – or long-term – absence of a statewide HSS assessment, teachers, schools, districts, and counties are encouraged to utilize the assessment resources within the HSS Framework. There are many recommendations for formative and summative assessments that evaluate content apprehension, skill and literacy acquirement, as well as civics.

Do we need to wait for the state to approve new instructional materials aligned to the new HSS Framework?

- Districts do not need to wait for the state to adopt instructional materials to begin teaching the new HSS Framework. Because the HSS Framework aligns with best practices instruction, already there are some instructional materials available within California and nationally that align with the new Framework. Please see the Resources section of this toolkit to locate other materials that are aligned with the Framework.

Does the Local Control and Accountability Plan (LCAP) require schools to address history-social science?

- State law requires that every LCAP address eight specific state priorities. Priority #2 is the Implementation of State Standards, which includes the history-social science standards and the State Board of Education approved HSS Framework.
- Other state priorities, such as Priority #1 (which addresses students having appropriately assigned and credentialed teachers), Priority #3 (which requires students to be enrolled in a broad course of study), and Priority #4 (which focuses on pupil achievement through performance on standardized tests and other indicators of college and career readiness), can be used as ways to advocate for the many branches of social science – not only history, but government, economics, geography, civics, and sociology – as well as environmental literacy supports written into the HSS Framework.