SCIENCE IMPLEMENTATION ANNUAL REPORT

January 2018

Los Angeles Unified School District
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Superintendent's Message

The employees of the Los Angeles Unified School District believe that each child can achieve great things and that it is our responsibility to provide personalized, high quality instruction in a caring and welcoming environment. Understanding and engaging in science are essential academic achievements that we believe all students are capable of attaining. The goal of the California Next Generation Science Standards (CA NGSS) is to prepare California's students to be future citizens and future scientists.

Learning science depends not only on the accumulation of facts and concepts, but also on the development of an identity as a competent learner of science, with motivation and interest to learn more. Such identity formation is valuable not only for students who, over the course of a lifetime, will come to view themselves as scientists or engineers, but also for the great majority of students who do not follow these professional paths. Science learning in schools leads to citizens with the confidence, ability, and the inclination to continue learning about issues, scientific and otherwise, that affect their lives and communities.

There are so many students, teachers, and parents with fresh ideas and insights about the work of the District, and I am excited to engage with them and expand on our accomplishments. Through teamwork and a commitment to student achievement, we can continue to build a District that is unified in every way so that 100% of our students graduate ready for any path they choose.

Vivian Ekchian

Vivian Ekchian
Interim Superintendent

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Science is a way of thinking much more than it is a body of knowledge.

-Carl Sagan

American Astronomer

Mission

The mission of Los Angeles Unified School District is to support teachers and administrators in implementing a rigorous science instructional program that provides all students with authentic scientific and engineering learning experiences connected to real world phenomena to become critical-thinkers who can effectively collaborate and communicate scientific thinking and practices to solve real-life problems.

Vision

The vision of Los Angeles Unified School District is to ensure that by the end of 12th grade, all students have appreciation of the beauty and wonder of science; possess sufficient knowledge of science and engineering to engage in public discussion related to their everyday lives; are able to continue to learn about science outside school; and have the skills to enter careers of their choice, including, but not limited to, careers in science, engineering, and technology.

-Adapted from the National Research Council (NRC) and the California Science Framework

The most beautiful experience we can have is the mysterious. It is the fundamental emotion which stands at the cradle of true art and true science.

-Albert Einstein

Physicist

Introduction

The Division of Instruction (DOI) has developed a strategic approach to prepare for the full implementation of the California Next Generation Science Standards (CA NGSS), which will ensure that all students have access to a rigorous science curriculum to develop scientific literacy that will prepare them for college, career, and life. This implementation report is a dynamic document that will rely on a collaborative process of periodic feedback from classrooms, schools, local districts, and the community.

The implementation plan was developed to engage stakeholders in the conceptual and instructional shifts required to support students in mastering scientific inquiry and critical thinking. The CA NGSS are predicated on the following understandings:

1. K-12 Science education should reflect the interconnected nature of science as it is practiced and experienced in the real world.
2. The CA NGSS are student performance expectations – NOT curriculum.
3. The science concepts in the CA NGSS build coherently from K-12.
4. The CA NGSS focus on deeper understanding of content as well as application of content.
5. Science and engineering are integrated in the NGSS, from K-12.
6. The CA NGSS are designed to prepare students for college, career, and responsible citizenship.
7. The CA NGSS and California Common Core Standard for English Language Arts and Mathematics are aligned.

The Division of Instruction will employ existing structures, such as the Science Leadership Team, to develop teacher capacity by providing instructional resources aligned to the CA NGSS. This process will ensure coherence and equity across LAUSD by collaborating systemically with local districts and departments within the District, including Career Technical Education (CTE), Division of Special Education, Linked Learning, Gifted and Talented Education (GATE), Multilingual Multicultural Education Department (MMED), and Instructional Technology Initiative (ITI).

The history of science is the history of mankind's unity…

-George (Alfred Leon) Sarton

Science Historian

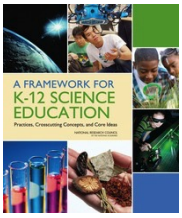
History of the Next Generation Science Standards

To compete and lead in the global economy, American students need to be able to pursue employment opportunities in science-related fields; therefore, students must have a solid K-12 science education that prepares them for college and for careers that do not yet exist. States had previously been using the *National Science Education Standards* from the National Research Council (NRC) and *Benchmarks for Science Literacy* from the American Association for the Advancement of Science (AAAS) to guide the development of their standards. Both sets of standards, though of high quality, are about 15 years old. Since the development of the two documents, there have been many advancements in the area of science. To incorporate these scientific advances and prepare our students for the future, the Next Generation Science Standards were created.

The Next Generation Science Standards (NGSS) were completed in April 2013, through a state-led process facilitated by Achieve Inc., a non-profit organization. The NGSS was developed from *A Framework for K-12 Science Education* by the National Research Council and emphasizes three dimensions of learning:

1. The development of scientific core ideas across multiple years;
2. The use of science and engineering practices with increasing sophistication across grade levels;
3. The application of crosscutting concepts as tools to understand and connect learnings in the various disciplines of science.

TIMELINE



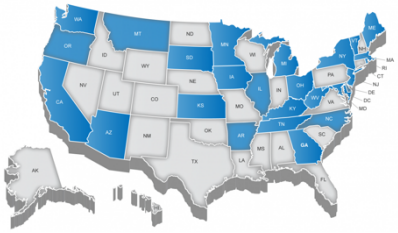
2012

The National Academy of Science through the National Research Council (NRC) released *A Framework for K-12 Science Education.*

2013

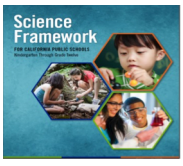
The California State Board of Education (CA SBE) adopted the NGSS in September 2013 as the new standards for science education in K-12 public schools

2013



California was one of the 26 states that collaborated to write The Next Generation Science Standards (NGSS), a process facilitated by Achieve, Inc.

2017



In March 2017, the CA SBE released the final draft of the CA NGSS Framework

California was one of the 26 states leading the development of the NGSS through the involvement of state experts and providing feedback. In September 2013, the California State Board of Education (CA SBE) adopted the NGSS for K-12 science instruction in public schools, and the title was changed to the California Next Generation Science Standard (CA NGSS). The CA NGSS are nearly identical to the original NGSS with the exception of a few modifications made to the clarification statements in the standards. The adoption was in alignment with the State Superintendent's Report, *A Blueprint for Great Schools* (California Department of Education 2011), and the CA SBE vision for all California students:

> ***All California students of the 21st century will attain the highest level of academic knowledge, applied learning, and performance skills to ensure fulfilling personal lives and careers, and contribute to civic and economic progress in our diverse and changing democratic society (SBE 2012).***

I try to show the public that chemistry, biology, physics, astrophysics is life. It is not some separate subject that you have to be pulled into a corner to be taught about.

-Neal DeGrasse Tyson
Astrophysicist

California Next Generation Science Standards Overview

Scientists have recognized that building scientific knowledge is a multi-dimensional process. French philosopher Poincaré described this process by stating, "*Science is built up with facts, as a house is with stone. But a collection of facts is no more a science than a heap of stones is a house.*" While all analogies have limitations, Poincaré's house analogy can be extended to one of the fundamental premises of the CA NGSS. Like the pile of stones lacking the necessary elements to be a house, the previous California State Science Standards provided the components of a good science education, yet lacked the conceptual shifts required to build 21st century skills. The CA NGSS reflect how science is done in the real world by intertwining Three-Dimensional Learning to create the conceptual shifts. The dimensions are:

1. **Science and Engineering Practices (SEPs)** – behaviors that scientists engage in as they investigate and build models and theories about the natural world, as well as the key set of engineering practices that engineers use as they design and build models and systems;
2. **Disciplinary Core Ideas (DCIs)** – key concepts, problems solving tools, and underlying principles of multiple science and engineering disciplines. The core ideas build on each other as students progress through grades. The DCIs are grouped into the following domains: Physical Science, Life Science, Earth and Space Science, and Engineering;
3. **Crosscutting Concepts (CCCs)** – help students explore connections across the four domains of science: Physical Science, Life Science, Earth and Space Science, and Engineering Design. These concepts help students develop a coherent and scientifically-based view of the world around them.

Along with Three-Dimensional Learning, the CA NGSS are kindergarten through grade 12 science content standards that set the learning expectations for what students should know and be able to do. The content standards are up-to-date, research-based standards that provide teachers with the flexibility to design learning experiences that motivate students to learn science and will prepare them for college and careers.

A New Vision for Science Education

Implications of the Vision of the Framework for
K-12 Science Education and the Next Generation Science Standards

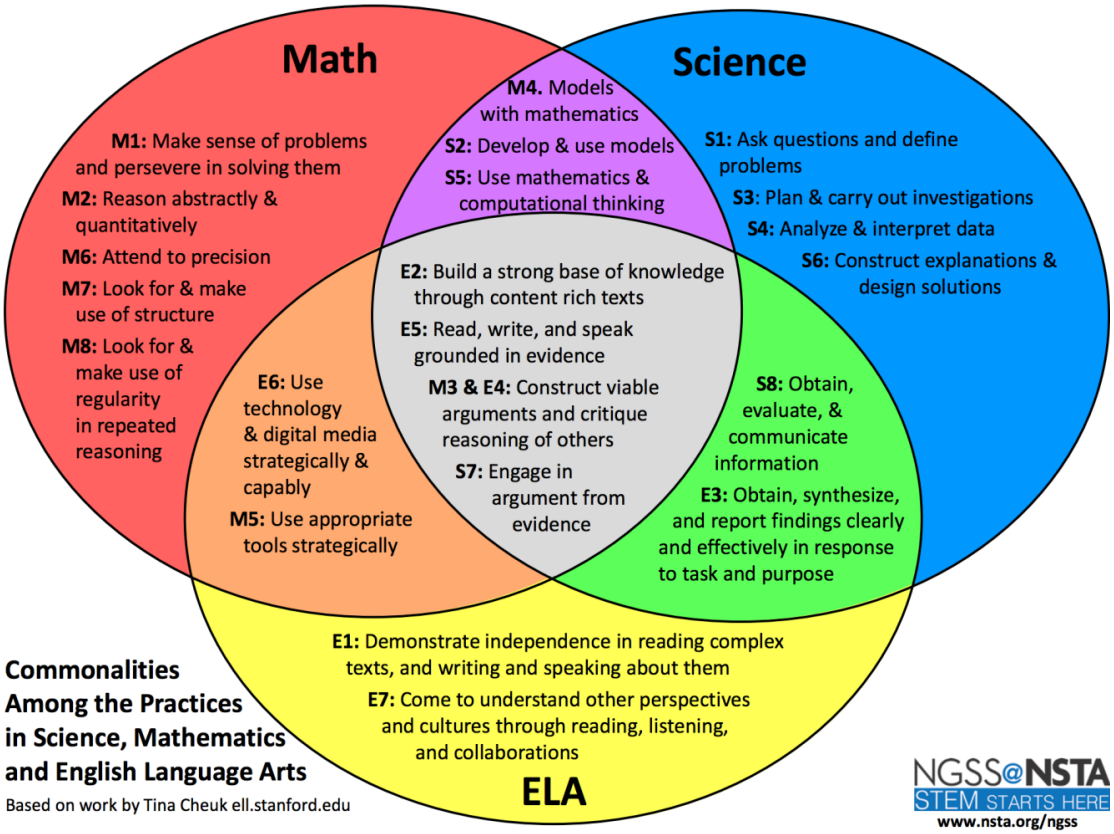
SCIENCE EDUCATION WILL INVOLVE LESS:	SCIENCE EDUCATION WILL INVOLVE MORE:
Rote memorization of facts and terminology	Facts and terminology learned as needed while developing explanations and designing solutions supported by evidence-based arguments and reasoning
Learning of ideas disconnected from questions about phenomena	Systems thinking and modeling to explain phenomena and to give a context for the ideas to be learned
Teachers providing information to the whole class	Students conducting investigations, solving problems, and engaging in discussions with teacher guidance
Teachers posing questions with only one right answer	Students discussing open-ended questions that focus on the strength of the evidence used to generate claims
Students reading textbooks and answering questions at the end of the chapter	Students reading multiple sources, including science-related magazine and journal articles, and web-based resources; students developing summaries of information.
Pre-planned outcome for "cookbook" laboratories or hands-on activities	Multiple investigations driven by students' questions with a range of possible outcomes that collectively lead to a deep understanding of established core scientific ideas
Worksheets	Students writing journals, reports, posters, and media presentations that explain and argue
Oversimplification of activities for students who are perceived to be less able to do science and engineering	Provision of supports so that all students can engage in sophisticated science and engineering practices

Source: National Research Council. (2015). Guide to Implementing the Next Generation Science Standards (pp. 8-9). Washington, DC: National Academies Press. http://www.nap.edu/catalog/18802/guide-to-implementing-the-next-generation-science-standards

The New California State Standards

The California Next Generation Science Standards are aligned to the vision and direction of the California Common Core Standards (CA CCSS) for Math and English. The three sets of standards ensure that all students have access to a high quality educational program. Science is a quantitative discipline that requires students to think abstractly. Incorporating basic quantitative skills like arithmetic, algebra, and statistics throughout the science curriculum will help students understand the concepts and connections between math and science to prepare them for college and careers.

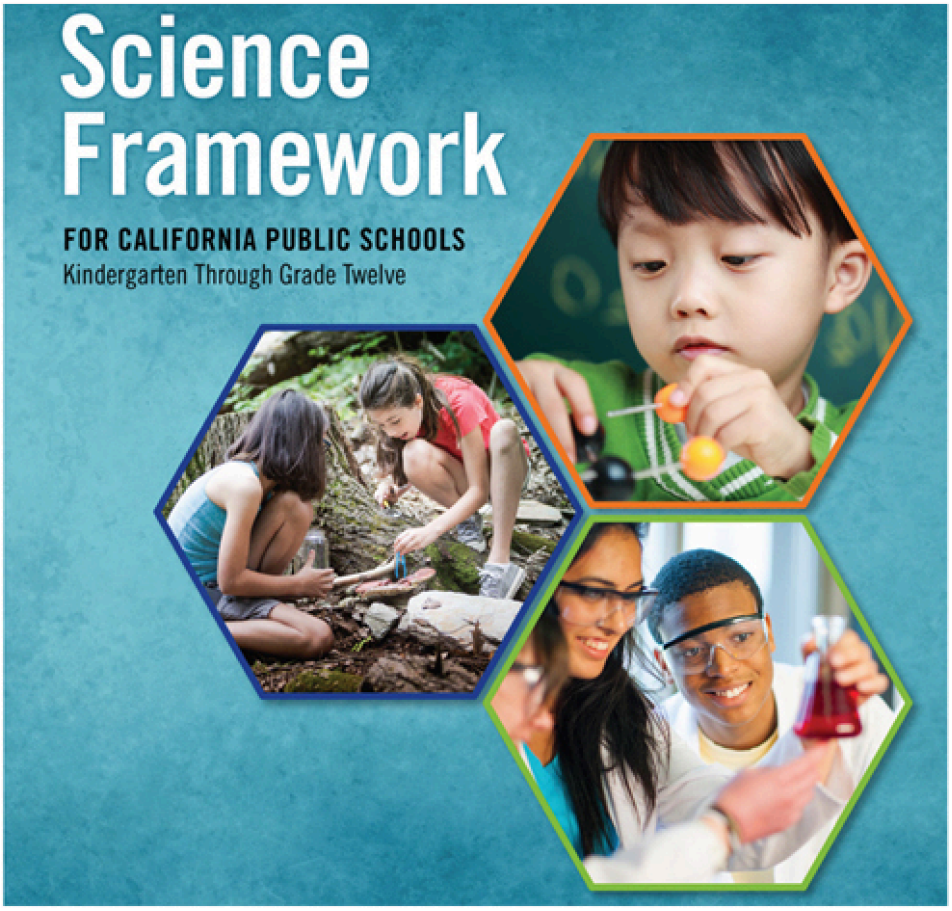
The CA NGSS Science and Engineering practices align with the CA CCSS Math Practice Standards. Both sets of standards require students to demonstrate their understanding of the content through the practices. Reading and writing make up a large part of what scientists do, making literacy essential to good scientific practice. The CA NGSS Science and Engineering Practices also align to the CCSS English in that students must learn how to construct arguments and communicate their thinking effectively. The CA NGSS combine literacy and language by having students validate evidence, construct sound reasoning, discuss theories, and critique hypotheses to strengthen science learning.



Framework Implementation

Extensive research of publications from the National Research Council (NRC), California Department of Education (CA CDE), and Achieve Inc. guided the development of the framework for the CA NGSS Implementation Plan. The plan is aligned to the overarching principles of the NRC's *Guide to Implementing the Next Generation Science Standards*. LAUSD's goal is to ensure that all students engage in Three-Dimensional Learning by supporting full implementation of the CA NGSS through professional learning for science teachers, alignment of instructional resources and assessments, engagement of all stakeholders, cultivation of partnerships, and leveraging of district and external resources. To achieve this goal, LAUSD has identified the following guiding principles:

- Making expectations and goals transparent through effective communication and engagement;
- Cultivating collaborative cultures in schools, local districts, and communities to achieve the benchmarks for implementation;
- Deepening learning to realize the uniqueness of science to support the development of scientific habits of mind;
- Developing accountability measures to ensure equity, guaranteeing that all students have access to the rigorous science education offered by LAUSD.



Science is curiosity. We all have natural curiosity. Science is a process of investigating. It's posing questions and coming up with a method.
It's delving in.

-Sally Ride
Astronaut

Implementation Progress

Los Angeles Unified School District

Next Generation Science Standards Implementation

2016 -2017

Instruction
- Middle School Integrated Model Roll-out
- STEAM Labs in Selected Schools

Curriculum
- NGSS Curriculum Pilot
- NGSS Units available to all schools

Build Capacity
- Ongoing professional development

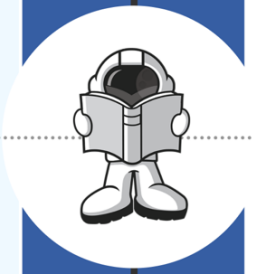
2017 -2018

Instruction
- Planning Instruction
- High School 3-Course Model Roll-out

Curriculum
- Piloting STEAM Certification
- Developing Tools and Resources

Build Capacity
- Ongoing professional development

2018 -2019



Instruction
- Full Implementation of NGSS

Curriculum
- Textbook Adoption
- STEAM Certification of Schools

Build Capacity
- Ongoing professional development

Standards Implementation

The District will ensure that all students have access to quality science instruction that develops scientific literacy as outlined in CA NGSS, and aligns explicitly to the California Content Standards for English Language Arts and Literacy as well as the California English Language Development Standards. LAUSD will meet this objective through:

1. **Instruction:** strengthen knowledge of the CA NGSS for all stakeholders through ongoing professional development and learning opportunities led by local districts, the Science Leadership Team and school science leads. The Division of Instruction (DOI) will maintain a working relationship between schools, local districts, and the Science Leadership Team that is dynamic and driven by the needs of schools;
2. **Curriculum:** pilot curricula that embodies the CA NGSS instructional shifts;
3. **Build Capacity:** support through professional development, resources, curriculum, instruction and assessment. DOI will also systematically collaborate with departments within LAUSD, including Career Technical Education (CTE), Special Education, Linked Learning, Gifted and Talented Education (GATE), Multilingual Multicultural Education Department (MMED), Instructional Technology Initiative (ITI), Parent Unit, and Human Resources (HR) to ensure coherence and equity across LAUSD;
4. **Partnerships:** foster relationships with local universities, informal education centers, businesses, and city and state educational organizations to gain resources and expertise.

Paving the Road to CA NGSS

Los Angeles Unified School District has been implementing a standards-based preschool through grade 12 (P-12) science program since the adoption of the California Science Standards for P-12 Public Schools in 1998. As LAUSD transitions to implementing the CA NGSS, new structures will be established to enhance structures currently in place.

1. Instruction

The district's science/STEAM team for CA NGSS implementation consists of one elementary science coordinator, one secondary science coordinator, and two STEAM coordinators at the Division of Instruction, and a STEAM coordinator at each local district. During the transition to CA NGSS, the science/STEAM team meets twice a month with representatives from MMED, ITI, and Special Education to develop instructional resources and professional development to build a coherent instructional program to support all students' learning of the California Next Generation Science Standards.

In addition, a Science Leadership Team has been formed consisting of preschool through 12th grade teachers and administrators representing all Board Districts and local districts. The team plans and facilitates science teacher professional development centered around the CA NGSS.

Elementary Schools

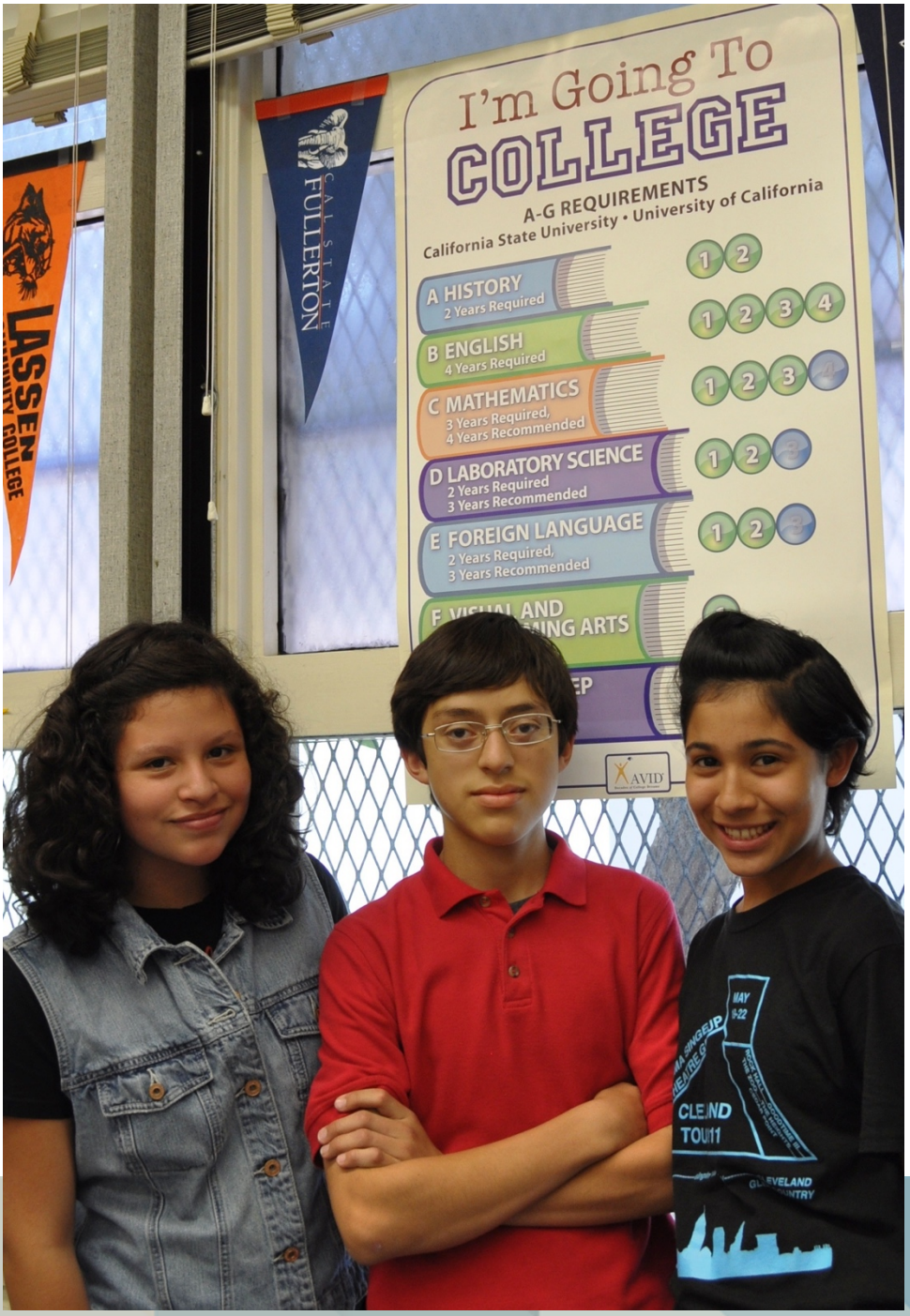
A 2004 Board Resolution requires 100 minutes of science instruction per week at the elementary level. To meet this requirement, content integration units for elementary have been developed during the 2014-2015 and 2015-2016 school years for third through fifth grade. The lessons are located at https://achieve.lausd.net/site/default.aspx?PageID=7862. These units are aligned to CA NGSS and support Three-Dimensional Science Learning. Approximately 1,450 teachers have been trained in implementing the content integration units.

In 2007, LAUSD adopted *Full Options Science System (FOSS)* curriculum developed by the Lawrence Hall of Science in Berkeley for elementary schools. In 2015-2016 *FOSS* was revised to address the CA NGSS. Since 2015, twenty-four teachers in 22 schools have piloted the new *FOSS* curriculum (See *Appendix A* for a list of schools).

At the same time, 21 teachers in 17 elementary schools have piloted the *Engineering Is Elementary* curriculum (See *Appendix A* for a list of schools).

Secondary Schools

In 2007, LAUSD adopted secondary science instructional materials aligned to the 1998 California Science Standards. These materials are not aligned to the instructional shifts of the CA NGSS. The state of California will adopt CA NGSS instructional materials during the 2018-2019 school year. To support the transition to the CA NGSS, the Science Leadership team has developed lessons aligned to the CA NGSS through a collaborative lesson design cycle (plan, implement, analyze and revise). The lessons are the first step in implementing the CA NGSS. In addition, three curriculum pilots are being conducted at various school sites.



Science Technology Engineering Arts Math (STEAM)

To be competitive in a rapidly changing world, students must have the knowledge and skill sets to address the demands of a global economy. Toward that goal, LAUSD has recognized the importance of preparing students in the fields of STEAM, the integration of Science, Technology, Engineering, Arts, and Math. STEAM shows students how the scientific method can be applied to everyday life using computational thinking and real-world application of problem solving.

The district has over 140 schools with a STEM (Science, Technology, Engineering, and Math) or STEAM focus. Each school has a different STEM/STEAM emphasis from Biomedicine to Engineering to Robotics and more. To support these schools and expand the number of STEM/STEAM schools, the Division of Instruction has hired two STEAM coordinators, and each local district has hired one STEAM coordinator. The STEAM coordinators collaborate to create LAUSD resources to support STEM/STEAM programs across the district.

To ensure quality STEM/STEAM programs, the district will be piloting a certification process during Spring 2018. The pilot will support schools to design and implement a STEM/STEAM program that will result in student achievement and attainment of the district goals. This iterative certification process will lead schools to examine instructional programs, structures, lesson design, and stakeholder interactions that promote and effective STEM/STEAM school culture. The pilot will also establish learning communities that will allow for like-minded schools to share best practices and exemplars of their STEM/STEAM culture (See *Appendix B* for LAUSD STEM/STEAM Framework).

Instruction of All Students

English Learners

Teachers must ensure that English Learners are full members of the science classroom community. Their full engagement is predicated on providing language and literacy scaffolds that support English Learners in participating in the full rigor of the CA NGSS. CA NGSS expands our traditional notion of science mastery and offers new language opportunities for English Learners. Instead of focusing on isolated facts and vocabulary, it merges core scientific ideas and crosscutting concepts with scientific and engineering practices. Science and engineering discourse requires precise and explicit explanations of the world. Therein, language intensive practices and discourse, such as argumentation, are elevated. As a result, what you do with language, as well as using the "language of science," becomes an integral part of learning science. In other words, learning science requires the use of language in oral and written forms.

"Above all, English Learners routinely and frequently engage in discussions to develop content knowledge, use comprehension strategies and analytical skills to interpret complex texts, produce oral and written English that increasingly meets the expectations of the context, and develop an awareness about how English works to make meaning" (CA ELA/ELD Framework, chapter 2, page 114).

To support English Learners in learning science and developing English proficiency simultaneously, teachers need to:

- Engage students in purposeful activities
- Ensure that students experience multiple examples of language in use
- Call students' attention to ways in which language is used to communicate meaning in science

To support English Learners in participating in scientific discourse to learn science, teachers must provide English learners with language models of scientific discourse and explicitly model and teach students to:

- Ask questions to elicit amplification or clarification of an idea
- Restate an idea contributed by another
- Build on an idea contributed by another
- Provide evidence to support their ideas
- Orally summarize their most advance learning

Ultimately, the NGSS provide English learners with opportunities for authentic applications for language learning while advancing their understanding of science.

Culturally and Linguistically Responsive Pedagogy

Culturally and linguistically responsive teaching and equity-focused approaches emphasize validating and valuing students' cultural and linguistic heritage across the curriculum (California Science Framework for Public Schools, 2016).

Science education is a unique arena for integrating pedagogy that is responsive to the diversity and life experiences of California's students. To ensure that all students thrive in STEM/STEAM fields, teachers should adopt an *additive stance* toward the culture and language of their students by enacting the following principles:

- *Promote and model a positive disposition toward diversity*
- *Recognize and leverage cultural and experiential backgrounds*
- *Value language diversity and address language status*
- *Cultivate the development of Academic English.*

All students bring knowledge and experiences that have the potential to promote science learning. The cultural and linguistic knowledge and experiences that some children bring to school may not initially be seen as assets. When teachers—and the broader educational community—openly acknowledge and value students as individuals and as members of our communities and seek to integrate and build on the cultural and linguistic resources students bring to school, then this promotes positive relationships in classrooms, a positive self-image in students, and a deep respect for diversity among all students (Gay 2002; Ladson-Billings 1995; Nieto 2008). These dispositions and actions are critical for supporting all learners to achieve their full potential.

Culturally and Linguistically Responsive Teaching Principles

Promote and model a positive disposition toward diversity

Teachers should develop an awareness of a positive disposition toward their students' cultural and linguistic heritage and communication styles. Teachers should also exude a positive disposition about the science-related cultural frameworks and experiences students from diverse backgrounds bring to the classroom and generally promote positive dispositions toward diversity among all students (LeMoine 1999; McIntyre and Turner 2013; Moll et al.1992).

Recognize and leverage cultural and experiential backgrounds

Teachers should learn about their students' lives, seek out the science-related cultural and experiential knowledge and interests their students bring to school, and make connections to new STEM/STEAM learning. This includes instructional actions such as using texts that feature scientists from a variety of cultural and linguistic backgrounds, inviting students to share their experiential and cultural knowledge in science and engineering lessons, and addressing issues of social injustices related to science that have affected people of color, immigrants, and the socioeconomically disadvantage (McIntyre and Turner 2013).

Value language diversity and address language status

Teachers should convey the message that all languages and dialects of English are equally valid and useful in the classroom because multilingualism and dialect variation is natural. While students should be encouraged and supported to use the academic language of science, the language they use during discussions, group projects, and other group work (such as lab experiments) should be accepted with the focus on learning science, rather than students' use of their home dialects or primary languages to communicate their ideas. In addition, teachers should make transparent for their students, in developmentally appropriate ways, that standard English is preferred in school and necessary to learn for expanding opportunities in life and that bilingualism and dialecticism (proficiency in multiple dialects of English) are highly valued assets (Harris-Wright 1999).

Cultivate the development of academic English

Teachers should draw students' attention to academic uses of English in STEM/STEAM. They should integrate cognitively demanding and engaging tasks that allow students to develop their ability to use academic English in meaningful and authentic ways. Teachers should also demonstrate how academic English works to make meaning of science (disciplinary literacy). This includes helping students to develop their language so that they understand how and when to use different types of English to meet the language expectations of STEM/STEAM fields (Schleppegrell 2004; Spycher 2013).

Science and Students with Disabilities

How can we improve science teaching and learning for students with disabilities? Chapter 8 of the Science Framework for California Public Schools (2016) addresses the need for all science teachers to promote access and equity for all learners, particularly those who have been under-represented in science and engineering careers. Furthermore, the practices outlined throughout the Framework and in Chapter 8 are designed to help alleviate the inequities that have prevented a large number of California's youth, particularly those with diverse learning needs, from excelling in science and engineering. It states, "Science and engineering education should be designed and taught in such a manner that every student, regardless of background or learning characteristics, has access and benefits from deep and engaging science and engineering learning opportunities."

General education and special education teachers have a shared responsibility to ensure that students with disabilities have "rich, relevant, and engaging science and engineering programs, courses, and pedagogy" that allow students with varying learning, cognitive, and/or physical challenges to participate in science instruction in meaningful, personalized, and rewarding ways.

Students with disabilities will benefit from science instruction when teachers work collaboratively to support learning under the following three conditions, as defined in the Framework:

1. Standards are implemented within the foundational principles of Universal Design for Learning.

2. Evidence-based instructional strategies are implemented and instructional materials and curriculum reflect the interests and readiness of each student to maximize learning potential.
3. Appropriate accommodations are provided to help students access grade-level content and complete tasks successfully.

2. Curriculum

Curriculum plays a vital role in supporting students' learning of the CA NGSS and in developing their understanding of the application of science. Curriculum is a resource that guides students' learning of how science impacts technology, engineering and other aspects of today's society. The Division of Instruction understands the importance of curriculum; therefore, it has initiated a pilot of newly available curricula for kindergarten through 12th grade during our transition to CA NGSS from 2016-2018. In addition, the Science Leadership Team has been developing model units and professional development to support teachers in their instruction.

Science in Early Education

Research indicates that preschool children have a natural predisposition to explore the world around them. This natural curiosity towards acquiring knowledge sets a foundation for early education professionals to build scientific concepts. The California Preschool Learning Foundation states, "Preschool science is consistent with a constructivist approach to learning, in which children construct knowledge and build theories by interacting with the environment rather than passively taking in information."

For the district's youngest learners, science is accomplished through a language rich play-based environment with many adult interactions. Children build their foundation for scientific inquiry through observations and sharing the descriptions of their interactions.

Children also work in supportive environments, so they learn to compare and contrast skills. In addition, science should be integrated with other domains so that young children's development is strengthened in language, literacy, mathematics and social-emotional development.

The adopted curriculum for Early Childhood Education, *Creative Curriculum*, features integrated units of study that are hands-on, project-based investigations of topics grounded in children's real-world experiences. The units provide deep, first hand exploration of topics that develop inquiry, problem solving, and cross-curricular skills in relevant and meaningful settings. Specifically, young children in the District's preschool programs are exposed to three scientific domains: Physical Science, Life Science, and Earth Science. Within the Physical Science domain for example, children learn about the properties and characteristics of objects, motion, and changes in objects. An example of Life Science includes basic understandings of the life cycle and the critical events that take place in between. These early foundations in Life Science set the foundation for integrated studies in ecology, biology, and physics. Earth Science allows children to develop initial understanding about the physical properties of the earth around them. Through interactions with soil, weather, and natural materials, young children develop early understandings about their natural environment, eco-systems, and climate.

Elementary School

It is important for elementary school students to experience science concepts in action in order to understand them. Selected elementary schools are piloting the *Full Options Science System (FOSS) Next Gen* to engage students and teachers in the transition to CA NGSS. *FOSS* is a hands-on investigative approach to Learning science. LAUSD plans to expand the pilot to more elementary schools.

The Elementary Science Leadership Team has also developed interdisciplinary and engineering units for grades three through five. The units are designed to support teachers with the implementation of the instructional shifts. The units were tested in classrooms, revised based on teacher feedback and then distributed to schools for their use.

Middle School

The State Board of Education adopted two course sequence models for CA NGSS in grades 6-8. The models are the Preferred Integrated and the Discipline Specific. LAUSD adopted the *Preferred Integrated Model*. This model is an interdisciplinary method of teaching science, integrating life science, earth and space science, and physical science through engineering, technology and the application of the sciences. All District schools that offer science courses for grades 6 through 8 are required to fully transition to the Preferred Integrated Model by the 2018 – 2019 school year.

State-approved science curricula that are fully aligned to the CA NGSS will be available in 2019. This is the same year the state is scheduled to adopt new science instructional materials.

Currently, there are middle school curricula aligned to the CA NGSS developed by *Activate Learning*, *It's About Time*, and Lawrence Hall of Science. The lessons demonstrate the instructional shifts required of the implementation of CA NGSS. Middle schools and elementary schools with grade 6 participated in a grade 6-8 pilot of the curricula from January to June 2017 (See *Appendix C* for a list of schools). The pilot allowed teachers to understand the demands of the CA NGSS shifts. Participating teachers shared their learnings from implementing the curricula and analyzing student work, which helped identify needed supports for the full implementation of the CA Next Generation Science Standards.

High School

In 2017, the district adopted the California Department of Education NGSS 3-Course Model, to be implemented district-wide in the 2018-2019 school year for grades 9-12. The California Science Framework (2017) divides the high school performance expectations (PE) of the CA Next Generation Science Standards into 3 courses. These courses are designed to integrate related Earth Science performance expectations into biology, chemistry and physics. The course titles and descriptions are listed:

- Living Earth – Biology integrated with Earth Sciences
- Chemistry in the Earth System – Chemistry integrated with Earth Sciences
- Physics in the Universe – Physics integrated with Earth Sciences

Although this model includes three courses, students are not required to take all three courses in the sequence. They must meet the state graduation requirement, which includes one year of life science and one year of physical science.

In the 2016-2017 school year, a number of LAUSD high schools piloted three different types of curricula (*It's About Time*, *CREATE 4 STEM*, and *BioZone*) to provide insight into the needs of teachers as they implement the CA NGSS shifts (See *Appendix D* for a list of schools). *It's About Time* is a physics curriculum that focuses on the principles of the instructional shifts. *CREATE 4 STEM*, created by Michigan State University, is a physical science curriculum that fully aligns with CA NGSS. *BioZone* is a supplemental resource for Earth Science and Biology that provided teachers and students questions and data sets that promote the use of scientific and engineering practices.

On-line professional learning communities were created to provide feedback on the different curricula. During weekly on-line meetings, participating teachers discussed the impact the curricula had on student learning based on student work. The local district science specialists used the data from the on-line meetings to create professional development and instructional resources to support secondary science teachers as they transition to CA NGSS.

An additional pilot was also conducted in collaboration with the National Science Foundation in which 25 teachers, selected from all local districts, piloted the *Interactions*

science course (See *Appendix D* for a list of schools). *Interactions* received the approval of the University of California Office of the President to satisfy the laboratory science ("d") requirement of the "a-g" subject requirements. As a result of this pilot, the *Interactions* course will be available to all LAUSD high schools in the 2017-18 school year.

Curricular Maps

The Science Leadership Team developed curriculum maps to support science teachers with the transition to full implementation of the CA NGSS. The maps are a resource guide providing differentiation strategies for students, lessons, and a sequence to implement the California Next Generation Science Standards. The curriculum maps are available at https://achieve.lausd.net/science.

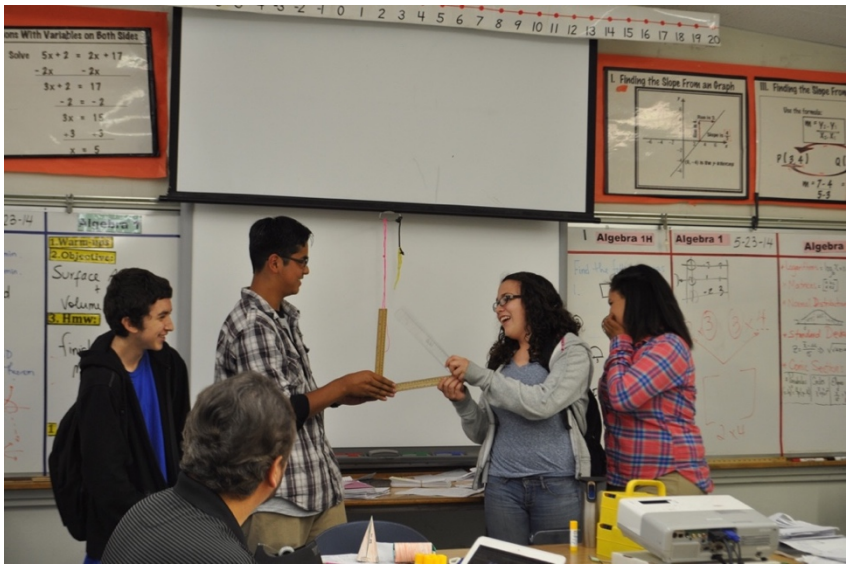
Universal Design for Learning

What is Universal Design for Learning (UDL), and how can teachers support students with disabilities in the general education classroom effectively? Access to the general education curriculum is a legal requirement that emphasizes the importance of aligning instructional strategies and supports to the grade-level expectations in the California standards for each content area (CDE, 2016).

Universal Design for Learning (UDL) is a framework for designing high quality instruction for all learners that builds on the variety of ways the brain processes learning (Meyer, Rose, & Gordon, 2014). Research has shown there are three networks of the brain that are activated during learning:

- The recognition networks of the brain gather and categorize facts and information, the "what" of learning. This region in the back of the brain stores what we see, hear, or read and organizes it for later use. For example, recalling facts or events is a function of the recognition networks.
- The strategic networks of the brain are designed to help learners plan for and perform tasks, the "how" of learning. This region is where executive functioning takes place as the brain retrieves knowledge stored in long-term memory and uses it for novel and strategic tasks. For example, solving a multi-step math problem and composing an essay are functions of the strategic networks.

- The affective networks of the brain reveal how learners get engaged and stay motivated, the "why" of learning. This includes how we are challenged, excited, or interested in the task at hand, and this is often referred to as the "emotional core" of the brain.



COMPUTER SCIENCE IN LAUSD

In 2017-18, 62.4% of L.A. Unified high schools offer at least one computer science course (i.e. Exploring Computer Science, Computer Programming, Computer Science, Advanced Placement Computer Science A, or Advanced Placement Computer Science Principles) that includes programming and 4.61% of LAUSD secondary students (9th-12th) are enrolled in at least one computer science course that includes programming. In order to meet the current and forecasted industry demands for computer science as well as prepare our students for college and career,

LAUSD | INSTRUCTIONAL TECHNOLOGY INITIATIVE
COMPUTER SCIENCE EDUCATION

LAUSD has taken several steps toward implementing computer science education. For instance, LAUSD approaches computer science as a literacy and is working toward integrating computational thinking across curriculum at several schools. Partnerships with Code.org and University of California Los Angeles (UCLA) were established to explore new curriculum and instruction. LAUSD adopted and implemented rigorous and relevant courses across multiple campuses including AP Computer Science Principles, Exploring Computer Science, and Computer Science Discoveries. Teachers volunteered to learn new curriculum and instruction created from recommendations by the College Board, the Computer Science Teachers Association (CSTA), Common Core State Standards, K-12 Computer Science Framework, the 21st Century Learning Framework, Code.org, universities, and other computer science stakeholders.

LAUSD became the first district to adopt the new International Society for Technology Education (ISTE) Standards for Students released in 2016, which are learner driven and focused on computational thinking. The Instructional Technology Initiative (ITI) Practitioner Schools 2.0 embraced the ISTE Standards for Students and the K-12 Computer Science Framework, leveraging them as a guide to strategically and systematically provide students with opportunities to cultivate computational thinking through interdisciplinary instruction. Computer science is its own discipline and is currently supported by the Instructional Technology Initiative where both teams work to bring computer science to every student in LAUSD by creating equitable access to rigorous and relevant computer science courses.

> ***"Well to me computer science is now the major that I want. Ever since I took Computer Science Principles I realized that I really liked Computer Science and it would be both a fun and promising major to pursue, and perhaps a career with it too. The class expanded my perspective on computer science and its possibilities. Computer science to me is no longer a difficult major taken only by those who like to spend hours in a dark room with a computer, rather, it is an opportunity."***
>
> ***-- Juan Ramirez (LAUSD student)***

"Computer science is another language for me. By coding and programming, I'm able to create a message and communicate it with others. It's opened my eyes to a whole new world."

-- Nancy Lopez (LAUSD graduate)

L.A. UNIFIED VISION FOR COMPUTER SCIENCE EDUCATION

The Los Angeles Unified School District is committed to providing computer science education for all students by 2025, and ensuring every student receives 20 hours of computer science instruction each year in Pre-K – 5th grades, completes at least one rigorous and relevant computer science course in grades 6-8, and has access to a computer science pathway in grades 9 through 12.

WHAT IS COMPUTER SCIENCE?

Computer science invites students to be creators of the technology they use and to become innovators and problem solvers in the creation of new technologies in every field. Computer science supports students in understanding the HOW and WHY of computing systems, the network and internet, data and analysis, algorithms and programming, and the impacts of computing, while developing their capacities in critical thinking and problem solving, collaboration, and communication.

WHY COMPUTER SCIENCE?

Computing devices are everywhere and in everything we use. From medicine to media, computers have changed our lives in ways that we could never have imagined. Computer science cultivates innovation, sparking creativity, critical thinking, communication, and collaboration, while imposing computational thinking skills on all. Understanding the technology around us and applying that knowledge to create new innovations empowers our students to be competitive in the 21st Century.

In the research report *The Case for Improving U.S. Computer Science Education*, Nager and Atkinson state that the most important STEM field for a modern economy is not only one that is not represented by its own initial in "STEM", but also the field with the fewest number of high school students taking its classes. It is also by far the one that has the most room for improvement, and that is computer science (2016). In 2017, every industry

involves computing jobs, which means schools all over the world must update their curricula to ensure students graduate college and career ready. In 2016, a Gallup Poll reported that even though 93% of parents want their child's school to teach computer science, only 40% of U.S. schools offer computer science courses that include programming. To learn more about LAUSD's Instructional Technology Initiative and Computer Science Education please visit https://achieve.lausd.net/iti and https://achieve.lausd.net/page/10023.

Pathways

The CA NGSS come alive in many of the STEM and STEAM pathways that LAUSD and Linked Learning offer. Students experience the application of these standards in authentic, real-world, interdisciplinary projects, often working side-by-side with scientists and other science professionals. These pathways have partnerships with the Coastal Marine Biolabs, Amgen, Kaiser Permanente, Hollywood Presbyterian, LAUSD Engineering Department, LAUSD Information Technology Department, Amazon Web Services, and STEM programs at colleges such as California State University Channel Islands, the USC Viterbi School of Engineering, and the Resnick Sustainability Institute of the California Institute of Technology. There are dozens of other STEM and STEAM career technical education pathways that also provide our students with hands-on experiences in the world of science.

The STEM Academy of Boyle Heights completed their first year as a Linked Learning pathway. Students' developed their 21st Century skills to lead in the areas of science, technology, engineering, and mathematics through a rigorous academic program in conjunction with community partners to accomplish real world projects. This past summer, students from the STEM Academy participated in a pilot program at USC Viterbi School of Engineering. They were introduced to 15 STEM career fields such as Aerospace, Biomedical Engineering, Environmental Science, Industrial Engineers, and Spatial Science.

Students in the Roosevelt High School STEAM Academy, a Linked Learning pathway, will be taking an Amazon Web Services (AWS) course that will eventually lead to the AWS Associate Certificate. Students can currently earn an A+ industry certificate, which is an internationally recognized validation of the technical knowledge required of foundation level IT practitioners.

Reseda High School has a rigorous Linked Learning Biomedical program. In addition to teaching Project Lead the Way classes in Biomedical Science and Innovations, the pathway partners with California State University Channel Islands where students work with graduate students in ongoing research, including biodiversity monitoring using DNA barcoding. Students also benefit from their partnership with Coastal Marine Biolabs, where students participate in data collection and research to contribute to the International Barcode of Life (iBOL) projects to create a DNA barcode to identify all species of organisms on Earth. Students also earn a Biotechnology/Biomanufacturing Certification through classes taught at both the high school and at LA Valley College. This certificate makes students employable at Biotechnology companies.

The graduation rate at STEM Academy of Hollywood, a certified Linked Learning pathway, grew from 68% to 93% over four years. Smarter Balanced Assessment (SBA) in ELA improved from 43% met/exceed to 73% met/exceed over three years and SBA in Math improved from 24% to 39% met/exceed in three years. Enrollment increased from 380 to 580 students over five years. This pathway has a mentoring program with Kaiser Permanente. In Year 1, there were 18 students mentored by 18 physicians and four years later, 40 students are mentored by 40 physicians. In their first year, STEM Academy of Hollywood offered two CTE classes; today they offer 12, including such courses as Medical Interventions, Biomedical Innovations, Aerospace Engineering, and Exploring Computer Science. STEM students participate in paid internships at Kaiser Permanente, Hollywood Presbyterian, UCLA and the LAUSD Department of Engineering in the Facilities Branch.

To further support high school students with attaining their aspirations, LAUSD has adopted Naviance. This is a comprehensive college and career readiness internet platform that helps students become college-ready by identifying their strengths, discovering careers, and matching students to higher education institutions.

Science Center

The LAUSD Granada Hills Science Materials Center provides crucial district resources for the CA NGSS implementation. Granada Hills Science Materials Center stores and distributes science materials to schools. The science materials offered at this center include replacement materials for K-5 *FOSS* kits, dissection materials for middle and high school, piloted curricula, scale models for anatomy, and equipment such as Van De Graff generators. Items, including live organisms, are delivered to schools by the center.

The center supports science programs throughout LAUSD by:

- Supporting the implementation of *FOSS* Kits by
    - Building *FOSS* Editions for schools, especially for Williams textbook sufficiency compliance
    - Replenishing missing or damaged consumable *FOSS* materials
    - Coordinating with volunteers to service the *FOSS* Refurbishment Program
- Preparing and pre-packaging consumable and non-consumable materials
- Ordering support materials
- Online request system at https://achieve.lausd.net//cms/module/selectsurvey/TakeSurvey.aspx?SurveyID=284
- Communicating and coordinating with schools to participate in the refurbishment program
- Fulfilling science materials requests and routing out to schools
- Maintaining an inventory system for various science materials programs
- Managing all materials to meet OSHA and OEHS work requirements
- Supporting and maintaining P-12 CA NGSS pilot programs.

3. Build Capacity

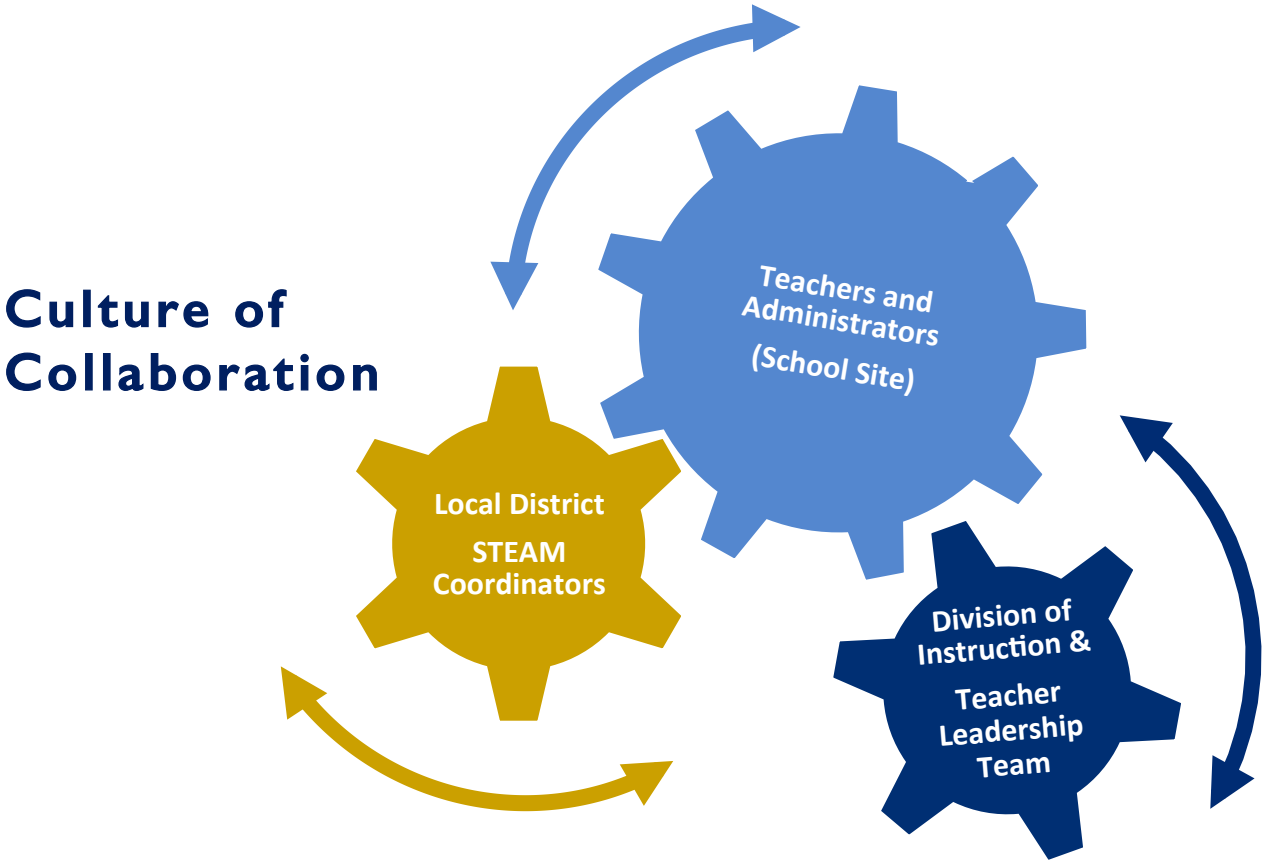
Teacher Capacity

Building teacher capacity is essential for student success. This requires leaders to focus on cultivating a collaborative culture of teaching and learning science. To cultivate a culture of collaboration, the Division of Instruction endorses a tiered leadership model to support the implementation of the CA NGSS at the school, local district, and district levels to build teacher capacity. The supports include:

- STEAM coordinators at each local district and the Division of Instruction to support the implementation of CA NGSS and STEM/STEAM;
- Regular cadre meetings for teachers and administrators, hosted by local district STEAM coordinators, to deepen their knowledge of CA NGSS;
- A Science Leadership Team consisting of Preschool-12 grade teachers and administrators, created by the Division of Instruction;
- Professional development, designed and facilitated by the Science Leadership Team, centered around the CA NGSS and CA English Language Arts Common Core Standards.

Administrator Leadership Capacity

To monitor and support the implementation of local science programs and CA NGSS, school site and district administrators will receive support through professional development on science content and practices, and build an understanding of the new science assessment system as a tool to inform instruction. The Division of Instruction STEAM coordinators, in collaboration with local district STEAM coordinators, will assist administrators with the implementation of CA NGSS and supporting student achievement in the sciences.



Stakeholder Capacity

The Division of Instruction collaborated with Parent and Community Services, Multilingual and Multicultural Education Department (MMED) and Access, Equity and Acceleration (AEA) unit to develop CA NGSS aligned resources to support the needs of LAUSD's diverse student population. This team, along with Instructional Technology Initiative (ITI), Special Education Division, and local district administrators, will hold a summit once a year to ensure stakeholder involvement and sustainability of the implementation of the CA NGSS.

4. Partners

LAUSD has partnered with businesses, universities and other organizations to collaboratively support student learning of the CA NGSS. The partnerships provide students with opportunities to see the beauty of science in action, experience STEM/STEAM related careers through internships or work-study programs, and to understand how the sciences have shaped the world of today and support the development of tomorrow. Our list of partners continues to grow.

Supporting LAUSD high school students by providing outreach programs in STEAM

Provides PD and funding for development of model lesson. Also, LADWP host the regional Science Bowl

Provided content experts for PD and content development aligned to CA NGSS. In addition, they are developing Interim Assessments for grades 3 through 5

Developed curriculum and assessment aligned to CA NGSS

Collaboration to provide elementary teachers CA NGSS aligned PD

Developed curriculum and assessment aligned to CA NGSS

Assisted with lesson development and resources to support the Board Resolution on Drought Awareness

Provides summer internships to LAUSD students

Provides teacher PD on water concerns aligned to CA NGSS. Also, hosts no cost fieldtrips for LAUSD schools

Partnership with the San Fernando Valley Science Project to support the rollout of the 3-Course Model.

Collaboration to provide elementary teachers CA NGSS aligned PD

Provides summer institute for K through 6 teachers and follow up PD on CA NGSS

Equity in science education requires that all students are provided with equitable opportunities to learn science and become engaged in science and engineering practices; with access to quality space, equipment, and teachers to support and motivate that learning and engagement; and adequate time spent on science. In addition, the issue of connecting to students' interest and experiences is particularly important for broadening participation in Science.

-NRC Framework, p. 28

New Assessment System

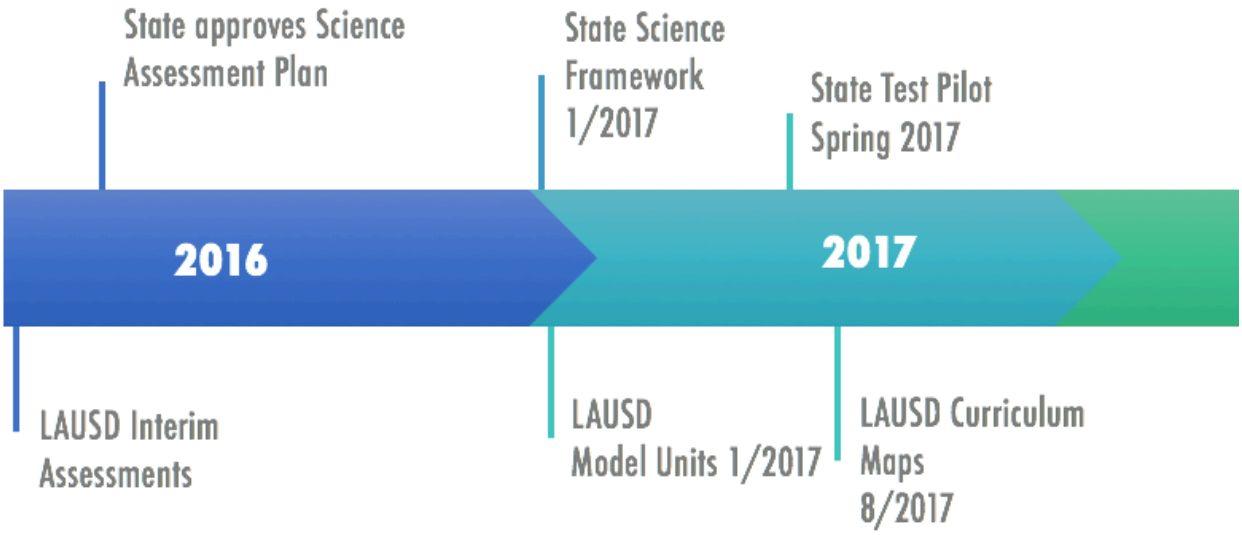
New Assessments

California will be implementing a new computer-based science assessment known as the California Science Test, or CAST beginning in Spring 2019. The alternate science assessment, for students with special needs, is called California Alternate Assessment (CAA) for Science. The CAA for Science is administered one-on-one by a trained test examiner who is familiar with the student's need(s). The CAST and CAA for Science will be administered in grade 5, 8, and once in grades 10-12.

In the Spring of 2017, all local districts piloted the CAST and CAA for Science as part of the 2016-2017 California Assessment of Student Performance and Progress (CAASPP). The assessment was administered to all 5th an 8th grade students. The California Department of Education (CDE) assigned each high school a grade to be assessed in science. During Spring of 2018, the year 2 pilot test of the CAA for Science will be administered to students in grades 5, 8 and one assigned high school grade.

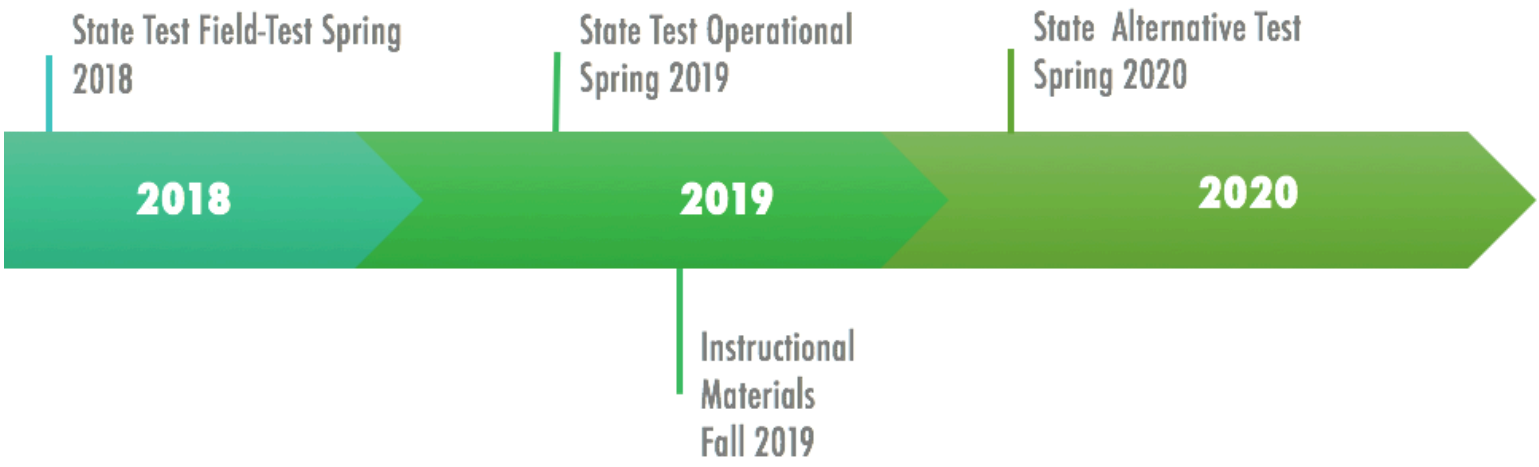
Interim Assessments

Beginning of the 2015-2016 school year, a committee of classroom teachers developed secondary CA NGSS aligned interim assessment items available from Achieve and Concord Consortium. Local district and Division of Instruction science staff vetted and added the items to the LAUSD interim assessment portal for teacher and school use to make data informed instructional decisions.



To support schools with informing their instruction based on data, the Division of Instruction worked with Lawrence Hall of Science and Measured Progress.
The Division of Instruction partnered with the Lawrence Hall of Science to develop NGSS aligned interim assessments for grade 3-5 for the 2017-2018 school year. In the Spring of 2017, 27 LAUSD teachers piloted the interim assessments in grades 3-5. The Elementary Science Team and Lawrence Hall continue to collaborate to finalize the NGSS aligned interim assessment to align with the district's science plan.

To support secondary schools, the Division of Instruction contracted with Measured Progress to develop NGSS aligned interim assessments for the 2017-2018 school year. The Division of Instruction and the Science Leadership Team are working together to provide Measured Progress with timely feedback to ensure the development of coherent interim assessments, which align to the district's science plan.



Students should come to appreciate that science and the current scientific understanding of the world are result of many hundreds of years of creative human endeavor.

- NRC Framework, p. 9

Appendices

Appendix A: Elementary School Curriculum Pilot

			FOSS Pilot			Engineering is Elementary Pilot	
Elementary School	**Local District**	**2015-2016**	**2016-2017**	**2017-2018**	**2015-2016**	**2016-2017**	**2017-2018**
Acad Enrich Sci Mag	LD NW	X	X	X	X	X	X
Alta California El	LD NW	X					
Arlington Heights	LD W					X	X
Arminta St EL	LD NE				X	X	X
Beckford Chtr Enr St	LD NW				X		
Broadous EL M/S/T Mag	LD NE				X	X	X
Carson El	LD S	X	X	X			
Charnock Road El	LD W	X	X	X			
Coeur D'Alene El	LD W	X					
Compton Ave El	LD S	X					
Crescent Hts Bl El	LD W	X	X	X			
Crescent Hts Bl El Mag	LD W				X	X	X
Dixie Cyn CC	LD NE	X					
Eastman Ave El	LD E				X		
Flournoy El M/S/T Mag	LD S				X		
Gates St El	LD E				X	X	X
Griffin Ave El	LD E	X		X	X		
Hillside El	LD E	X	X	X		X	X
Hooper Ave El	LD C	X	X	X	X	X	X
Kittridge St El	LD NE				X		
Laurel Span School	LD W	X		X			
Lizarraga El	LD C				X		
Lomita El M/S/T Mag	LD S	X	X	X	X	X	X
Marquez El Charter	LD W	X	X	X	X	X	X
Marvin El	LD W				X	X	X
Melrose Ave El M/S	LD W	X	X	X	X	X	X
Normont El	LD S	X	X	X			
Norwood St El	LD C	X					
Rosa Parks Learning Center	LD NW				X		
Plainview Academy	LD NE					X	X
RFK New Open Wld Acad	LD C	X					
Rockdale VAPA Mag	LD C	X		X			

		FOSS Pilot			Engineering is Elementary Pilot		
Elementary School	**Local District**	**2015-2016**	**2016-2017**	**2017-2018**	**2015-2016**	**2016-2017**	**2017-2018**
Roscomare Rd El	LD W				X	X	X
Sunny Brae Ave El	LD NW	X	X	X	X	X	X
Telfair Ave El	LD NE	X	X				
Vena Ave El G/HA Mag	LD NE				X	X	X
Vintage El M/S/T/M	LD NW	X	X	X			

Local Districts

Local District Northeast: LD NE

Local District Northwest: LD NW

Local District East: LD E

Local District Central: LD C

Local District South: LD S

Local District West: LD W

Appendix B: LAUSD STEM/STEAM Framework

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LAUSD STEM/STEAM Framework

The STEM/STEAM Framework will guide school teams to develop effective and responsive programs for their students and the school community. The framework is organized in 8 categories:

I. Vision
II. Culture
III. Infrastructure
IV. Curriculum
V. Teacher Leadership
VI. Partners
VII. Equity and Access
VIII. Accountability

These categories are further organized by criteria. Schools can self-assess and will be evaluated on a scale from Developing to Expanding. There are sample artifacts listed to guide schools on the types of evidence that can be included in their portfolio in Step 3 of the certification process.

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I. Vision

Criterion	Developing 1 point	Practicing 2 points	Sustaining 3 points	Expanding 4 points
Vision Development	STEM/STEAM Vision is in the process of being created.	STEM/STEAM Vision is created by a few individuals.	STEM/STEAM Vision is created with school wide input.	STEM/STEAM Vision is embraced by the school and community, and reviewed regularly with stakeholders.
Vision Communicated to Stakeholders	STEM/STEAM vision is created without being communicated to stakeholders.	STEM/STEAM vision is communicated to some stakeholders.	STEM/STEAM vision is communicated to all stakeholders, but the evidence of vision in the school culture is inconsistent.	STEM/STEAM vision is communicated to all stakeholders and evident in the school culture.

Sample Artifacts:

- Students can articulate how the vision connects to the learning in the classroom.
- Meeting logs for collective development of the vision.
- The STEM/STEAM Vision is presented to the Community during town hall meetings.

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II. Culture

Criterion	Developing 1 point	Practicing 2 points	Sustaining 3 points	Expanding 4 points
Growth Mindset	Learning environment is designed so that some stakeholders (students, teachers, administrators, parents, partners, etc.) encourage a growth mindset.	Learning environment is designed so that all stakeholders (students, teachers, administrators, parents, partners, etc.) encourage a growth mindset.	Learning environment is designed so that all stakeholders (students, teachers, administrators, parents, partners, etc.) develop a growth mindset and have a system in place to sustain the efforts.	Learning environment is designed so that all stakeholders (students, teachers, administrators, parents, partners, etc.) possess a growth mindset and embrace challenges for continual growth.
Cultivate Collaborative Culture	Some stakeholders are beginning to participate in a collaborative community.	Some stakeholders participate in a collaborative community.	All stakeholders participate in a collaborative community.	All stakeholders embrace and sustain a collaborative community.
Teacher Collaboration	Teachers co-create lessons or units of instruction. Teachers determine the learning objectives and how the mastery will be assessed.	Teachers co-create units of instruction through a cyclical process: design-deliver-revise and refine. Teachers determine the learning objectives and how the mastery will be assessed.	Teachers co-create interdisciplinary units of instruction through a cyclical process: design-deliver-revise and refine. Teachers determine the learning objectives and how the mastery will be assessed.	Teachers co-create interdisciplinary units of instruction through a cyclical process: design-deliver-revise and refine. Teachers determine the learning objectives and how the mastery will be assessed. Teachers

II. Culture (continued)

				collaboratively determine enrichment options to move students forward.
Learning Agency - Elements of 21st Century Learning (Critical Thinking Collaboration Creativity Communication)	Learning environments are oriented to support student development in one of the four areas: critical thinking, collaboration, creativity, and communication.	Learning environments are oriented to support student development in two of the four areas: critical thinking, collaboration, creativity, and communication.	Learning environments are oriented to support student development in three of the four areas: critical thinking, collaboration, creativity, and communication.	Learning environments are oriented around all elements of 21st century skills to support student development in critical thinking, collaboration, creativity, and communication.

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II. Culture (continued)

Criterion	Developing 1 point	Practicing 2 points	Sustaining 3 points	Expanding 4 points
Teacher Collaboration	Teachers co-create lessons or units of instruction. Teachers determine the learning objectives and how the mastery will be assessed.	Teachers co-create units of instruction through a cyclical process: design-deliver-revise and refine. Teachers determine the learning objectives and how the mastery will be assessed.	Teachers co-create interdisciplinary units of instruction through a cyclical process: design-deliver-revise and refine. Teachers determine the learning objectives and how the mastery will be assessed.	Teachers co-create interdisciplinary units of instruction through a cyclical process: design-deliver-revise and refine. Teachers determine the learning objectives and how the mastery will be assessed. Teachers collaboratively determine enrichment options to move students forward.
Learning Agency - Elements of 21st Century Learning (Critical Thinking Collaboration Creativity Communication)	Learning environments are oriented to support student development in one of the four areas: critical thinking, collaboration, creativity, and communication.	Learning environments are oriented to support student development in two of the four areas: critical thinking, collaboration, creativity, and communication.	Learning environments are oriented to support student development in three of the four areas: critical thinking, collaboration, creativity, and communication.	Learning environments are oriented around all elements of 21st century skills to support student development in critical thinking, collaboration, creativity, and communication.

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II. Culture (continued)

Criterion	Developing 1 point	Practicing 2 points	Sustaining 3 points	Expanding 4 points
Family Education	STEM/STEAM related family education opportunities are available at the school site at least once a semester.	STEM/STEAM related family education opportunities are available at the school site on an as needed basis.	STEM/STEAM related family education opportunities are on-going at the school site.	Families are involved in planning, leading and participating in parent education opportunities related to STEM/STEAM.
Family/Community Events	STEM/STEAM related family/community events are still in the planning stages.	STEM/STEAM related family/community event is offered once a year at the school site.	STEM/STEAM related family/community events are on-going at the school site.	Families, community and students are involved in planning, leading, and participating in the Family Events.

Sample Artifacts:

- School hosts a STEM/STEAM Festival with students leading the exhibits.
- Parent center has STEM/STEAM classes to inform parents of the STEM/STEAM Programs.
- Student artifacts demonstrate engagement in the math, and science and engineering practices.
- Students demonstrate growth mindset through portfolios.
- Teachers model growth mindset by demonstrating strategies to learn from “failures.”

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III. Infrastructure

Criterion	Developing 1 point	Practicing 2 points	Sustaining 3 points	Expanding 4 points
Resources (e.g. STEM/STEAM labs, computer access for students, makerspace, supplemental instructional materials, etc.)	The school is in the planning stages for acquiring the resources to achieve the STEM/STEAM environment.	The school is in the process of acquiring resources to achieve the STEM/STEAM environment.	The school has all the necessary resources to achieve the STEM/STEAM environment and a commitment and systems to maintain the resources.	The school is reflecting on and improving their existing resources to expand on the STEM/STEAM environment.
Schedules (Bell schedule, master schedule)	Schedule(s) have not yet been modified to support the implementation of a STEM/STEAM environment.	Schedule(s) are adjusted to accommodate the STEM/STEAM environment.	Schedule(s) accommodate the STEM/STEAM environment.	Schedule(s) are adjusted with supporting evidence to refine the STEM/STEAM environment.

Sample Artifacts:

- STEAM labs are well equipped and maintained.
- Makerspace is available for all students during the school day as well as after-school hours.
- Student schedules (e.g. modified block, 8 period day, etc.) accommodate the programming needs.
- Lab or Technology Assistants are funded to maintain space and equipment.

LAUSD Certification Pilot Spring 2018 (pages 47 – 61)

IV. Curriculum

Criterion	Developing 1 point	Practicing 2 points	Sustaining 3 points	Expanding 4 points
Integrated STEM/STEAM Curriculum	There is evidence for the development of an explicit integrated STEM/STEAM curriculum and applied with a small population students.	An integrated STEM/STEAM curriculum is currently implemented for the majority of students (e.g. a specific grade level).	All students are exposed to an explicit integrated STEM/STEAM curriculum and there is evidence of its sustainability.	There is evidence of refining the existing explicit integrated STEM/STEAM curriculum to meet the needs of all students.
Rigor	Students solve problems. Instruction is predominantly teacher centered.	Students solve real-world problems centered on one discipline at a time. Instruction is predominantly student centered.	Students solve real-world problems. Instruction is predominantly student centered and students extend and refine their acquired knowledge to routinely analyze and solve problems that involve more than one discipline.	Students identify and research concepts and principles they need to know to work through complex real-world problems. Students are able to create solutions and take action when confronted with perplexing unknowns that involve more than one discipline.

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IV. Curriculum (continued)

Criterion	Developing 1 point	Practicing 2 points	Sustaining 3 points	Expanding 4 points
Assessments	Teachers use multiple indicators of success in each of the STEM/STEAM content areas, one discipline at a time.	Students articulate the learning goals. Teachers use multiple indicators of success in each of the STEM/STEAM content areas, one discipline at a time.	Students articulate the learning goals and their progress towards the goal. Teachers use multiple integrated indicators of success in STEM/STEAM.	Students articulate the learning goals and their progress towards the goal. Students develop strategies for reflecting on and refining their learning process. Teachers use multiple integrated indicators of success in STEM/STEAM. Departments and grade levels use common integrated assessments as one of the resources to inform planning and delivery of instruction.

Sample Artifacts:

- Students are participating in open-ended tasks with multiple entry points.
- Set time for regular teacher collaboration to develop lesson and assessment.
- Teachers and students attend UCLA's AP Readiness Institutes.
- School has a targeted rotating intervention program for struggling students.
- Teachers consistently check for understanding using multiple measure to revise instruction to meet the needs of the students.

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V. Teacher Leadership

Criterion	Developing 1 point	Practicing 2 points	Sustaining 3 points	Expanding 4 points
Teacher Professional Learning	STEM/STEAM related professional development is in the planning stages.	Staff participates in STEM/STEAM related professional development and there is evidence of application in half of the classrooms.	Staff engages in STEM/STEAM related professional development and there is evidence of application in three-quarters of the classrooms.	Staff engages in on-going STEM/STEAM related professional development and there is strong evidence of application in all classrooms.
School Site Professional Learning Provider	The school is in the planning stages for STEM/STEAM related PD provided by outside agencies (e.g. district coordinators, Universities, conferences, and outreach organizations).	STEM/STEAM related PD is provided by outside agencies (e.g. district coordinators, Universities, conferences, and outreach organizations).	STEM/STEAM related PD is developed in collaboration between teachers, administrators, and outside agencies (e.g. district coordinators, Universities, conferences, and outreach organizations).	STEM/STEAM related PD is coordinated, developed, and facilitated by teachers and administrators within the school site.

Sample Artifacts:

- Teachers co-develop the content for professional development time and take turns facilitating.
- Teachers document the evidence for implementation of strategies learned in the professional development.
- Teachers present at conferences.
- Teachers co-develop interdisciplinary units with common benchmarks and assessments.

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VI. Partnerships

Criterion	Developing 1 point	Practicing 2 points	Sustaining 3 points	Expanding 4 points
Community Partnerships	The school is identifying partnerships to support their STEM/STEAM environment.	The school is initiating partnerships to support their STEM/STEAM learning environment.	Community partnerships are involved in connecting the STEM/STEAM instructional program directly to in-class learning.	Community partnerships are involved in an on-going, mutually beneficial relationship. The STEM/STEAM instructional programs are directly connected to in-class learning.
STEM/STEAM Learning through Community Based Projects	Students learn about various community based projects.	Some students participate in various community based projects.	All students participate in various community based projects.	Students initiate and actively participate in various community based projects.

Sample Artifacts:

- Business or universities collaborate with teachers to design and implement STEAM lessons.
- Students take field trips to STEM/STEAM business and Universities.
- Students work with businesses or universities partners on real world projects or research.

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VII. Equity and Access

Criterion	Developing 1 point	Practicing 2 points	Sustaining 3 points	Expanding 4 points
Participation of students from populations underrepresented in STEM/STEAM Fields (minorities, females, students with disabilities, and economically disadvantaged)	School is in the planning stages addressing the need to include underrepresented student populations.	School has outreach support that focuses on the majority of underrepresented student populations.	School has outreach support that focuses on 100% participation from underrepresented student populations that reflects the diversity and gender of the community.	School refines its outreach support to respond to any changes in the school community to meet 100% participation from underrepresented student populations that reflects the diversity and gender of the community.
Access to Curriculum (Universal Design for Learning)	Students receive a rigorous curriculum where they can demonstrate mastery in one representation.	Some students receive a rigorous curriculum with multiple entry points where they can demonstrate mastery in multiple representations.	All students receive a rigorous curriculum with multiple entry points where they can demonstrate mastery in multiple representations.	All students take ownership of learning a rigorous curriculum with multiple entry points where they can demonstrate mastery in multiple representations.

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VII. Equity and Access (continued)

Criterion	Developing 1 point	Practicing 2 points	Sustaining 3 points	Expanding 4 points
Access to STEM/STEAM Advanced Learning Options (High School Only)	50% of students who are enrolled in AP/IB/Dual Enrollment in STEM/STEAM courses are successful. (Success is defined by the school, e.g. 3 or better on AP exam)	50% of students who are enrolled in AP/IB/Dual Enrollment in STEM/STEAM courses are successful. (Success is defined by the school, e.g. 3 or better on AP exam)	75% of students who are enrolled in AP/IB/Dual Enrollment in STEM/STEAM courses are successful. Additional supports are instituted to assist students in meeting these expectations. (Success is defined by the school, e.g. 3 or better on AP exam)	100% of students who are enrolled in AP/IB/Dual Enrollment in STEM/STEAM courses are successful. The school provides additional supports to assist students in meeting these expectations. (Success is defined by the school, e.g. 3 or better on AP exam)

Sample Artifacts:

- Student artifacts show engagement in Project Based Learning.
- Master schedule (secondary) shows various STEAM electives being offered to all students.
- Student artifacts demonstrate Universal Design for Learning strategies.

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VIII. Accountability

Criterion	Developing 1 point	Practicing 2 points	Sustaining 3 points	Expanding 4 points
School Self-Assessment and Reflection	Some stakeholders can articulate the STEM/STEAM goals.	All stakeholders can articulate the STEM/STEAM goals.	All stakeholders can articulate the school's progress towards STEM/STEAM goals citing evidence aligned to the school's vision.	All stakeholders can articulate the school's progress towards STEM/STEAM goals citing the evidence and data aligned to the school's vision. There is a system in place for all stakeholders to reflect and respond to needs.

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VIII. Accountability (continued)

Criterion	Developing 1 point	Practicing 2 points	Sustaining 3 points	Expanding 4 points
Transparency	Leadership encourages all stakeholders in school site decision making.	Leadership includes all stakeholders in school site decision making.	Leadership includes all stakeholders in school site decision making. Systems are being developed to respond to the changes in the community demographics and needs as the STEM/STEAM program is implemented.	Leadership includes all stakeholders in school site decision making. Systems are in place to respond to the changes in the community demographics and needs as the STEM/STEAM program is implemented.

Sample Artifacts:

- Research-based strategies are in the school plan to improve student outcomes.
- Dates and agendas for STEM/STEAM Plan Review are communicated to all stakeholders.
- Meeting agendas and notes reflect data analysis to evaluate the implementation.

Appendix C: Middle School Curriculum Pilot

Middle School	Local District	Activate Learning	It's About Time	Lawrence Hall of Science
32nd Street School	LD C		X	
93rd Elementary	LDS			X
96th St. Elementary	LD S		X	
Arroyo Seco MM	LD C			X
Atwater STEAM EL	LDC			X
Audubon MS	LD W	X	X	X
Avalon Garden	LDS		X	
Belvedere MS	LD E		X	X
Berendo MS Dual Language	LD C	X		
Burroughs MS	LD W			X
Byrd MS	LD NE		X	X
Clifford Math/Tech	LDC	X		
Clinton MS	LD C	X		
Cochran MS	LD W	X		X
Columbus MS	LD NW			X
Dana STEAM Magnet	LD S	X		X
Eagle Rock ES	LD C	X		
Edison MS	LD S	X		X
El Sereno ES	LDE	X		X
Elysian Heights	LD C			X
Emerson MS	LD W	X		X
Evergreen ES	LD E			X
Fleming MS	LD S			X
Foshay LC	LD C	X		X
Franklin HS - Dual Language	LDC	X		
Frost MS	LD NW			X
Fulton College Prep	LD NE			X
Gage MS	LD E	X	X	X
Garvanza EL	LDC	X		
Glen Alta Span	LD E			X
GlenFeliz EL	LD C			X
Glenn Hammond Curtiss	LD S	X		
Gompers MS	LD S	X		
Gratts LA for YS	LDC			X
Griffith MS	LD E	X		X
Hale CA	LD NW			X
Hamasaki ES	LDE	X		

Middle School	Local District	Activate Learning	It's About Time	Lawrence Hall of Science
Harrison El	LD E			X
Henry MS	LD NW		X	X
Hollenbeck MS	LD E	X		X
Holmes ES	LDE	X		
Hughes ES	LDE	X		
Huntington Drive ES	LD E	X		
Incubator	LD W		X	
Irving MS	LD C		X	
John Liechty MS	LDC			X
Julian Nava Academy	LD C	X		
Julian Nava Business and Technology	LD C			X
LAAMS	LD C	X		
LACES	LD W	X	X	X
Lane ES	LD E			X
Laurel ES	LD W			X
Laurel Span	LD W		X	
Lawrence MS	LD NW			X
Le Conte MS	LD W	X	X	X
Liechty MS	LD C	X		X
Lillian ES	LDE			X
Lockwood EL	LD C	X		
Logan Span	LD C			X
Luther Burbank M	LDC	X		
Madison MS	LD NE	X	X	X
Manchester Elementary	LDS			X
Marianna ES	LD E			X
Marina Del Rey	LD W	X		
Mark Twain MS	LD W			X
Mayberry EL	LD C			X
Mc Bride Special Education Center	LD W			X
Middleton ES	LD E	X		
Millikan MS	LD NE	X		X
Mt Gleason MS	LD NE	X	X	X
Mt. Washington	LD C	X		
Muir MS	LD W	X		X
Muir MS	LD W			X
Murchison Street ES	LD E	X		X
New Open World Academy	LD C			X

Middle School	Local District	Activate Learning	It's About Time	Lawrence Hall of Science
Nightingale MS	LD E	X		X
Nimitz MS	LD E		X	X
Nobel Charter MS	LDNW		X	X
Northridge MS	LD NW		X	
Ochoa LC	LDE	X	X	X
Olive Vista MS	LD NE	X		X
Orchard Academy 2B	LD E		X	X
Orchard Academy 2C	LD E	X	X	X
Pacoima MS	LD NE	X	X	X
Park Ave ES	LD E			X
Patrick Henry MS	LD NW			X
Paul Revere MS	LD W		X	X
Plummer Elementary	LD NW			X
Porter Ranch Community School	LD NW	X		X
Portola MS	LD NW	X		
Rancho Dominguez Preparatory	LD S	X		
Reed MS	LD NE	X	X	X
Rockdale ES	LD C	X		
Romer MS	LD NE	X		X
Sal Castro MS	LD C		X	
San Fernando MS	LD NE	X	X	X
San Pascual STEAM	LDC	X		
Second St ES	LDE			X
Sepulveda MS	LD NW			X
Sheridan ES	LD E			X
Sierra Vista ES	LDE			X
SOCES Mag	LD NW	X		
Soto St ES	LD E			X
South Gate MS	LD E	X		X
South Park Elementary	LD S	X		
Southeast MS	LD E			X
Stephen White MS	LD S	X	X	
Stevenson MS	LD E	X	X	X
Sun Valley Magnet	LD NE	X	X	X
Sutter MS	LD NW	X		X
Sylmar Leadership Academy	LD NE			X
The Incubator School	LD W			X
The Science Academy STEM Magnet	LD NE			X

Middle School	Local District	Activate Learning	It's About Time	Lawrence Hall of Science
Thomas Starr King	LD C	X		
Toland Way	LDC			X
UCLA Comm @RFK	LD C		X	
Valley Altern Mag	LD NW		X	
Van Deene Elementary	LDS	X		
Van Nuys MS	LD NE	X		
Vine ES	LD W			X
Virginia Road ES	LD W			X
Vista MS	LD NE	X	X	X
Walnut Park Social Justice MS	LD E	X	X	X
Walnut Park STEM Academy MS	LD E		X	X
Webster	LD W		X	
Westside Global Awareness Magnet	LD W	X		
Wilmington MS	LD S			X
Wilmington STEAM Magnet	LD S	X		
Woodland Hills Acad	LD NW	X		
Wright MS	LD W		X	X
Wright MS STEAM	LD W			X
YOKA	LD C		X	
Yorkdale EL	LD C			X

Local Districts

Local District Northeast: LD NE

Local District Northwest: LD NW

Local District East: LD E

Local District Central: LD C

Local District South: LD S

Local District West: LD W

Appendix D: High School Curriculum Pilot

High School	Local District	Publisher	Pilot Program
Bernstein STEM	LD W	It's About Time	Active Physics
Chavez Learning Academy - Teacher Prep Academy	LD NE	It's About Time	Active Physics
Contreras Bus/Tourism	LD C	It's About Time	Active Physics
Contreras Social Justice	LD C	It's About Time	Active Physics
Garfield HS	LD E	It's About Time	Active Physics
Grant HS	LD NE	It's About Time	Active Physics
Hawkins CDAGS	LD W	It's About Time	Active Physics
Helen Bernstein HS	LD W	It's About Time	Active Physics
King Drew Medical Magnet	LD S	It's About Time	Active Physics
Maywood Academy	LD E	It's About Time	Active Physics
Panorama HS	LD NE	It's About Time	Active Physics
Rancho Dominguez Preparatory	LD S	It's About Time	Active Physics
Taft HS	LD NW	It's About Time	Active Physics
Belmont	LD E	CREATE 4 STEM	Interactions
Boyle Heights HS	LD NW	CREATE 4 STEM	Interactions
Boyle Heights STEM HS	LD C	CREATE 4 STEM	Interactions
Cleveland Charter High School	LD E	CREATE 4 STEM	Interactions
DBM	LD C	CREATE 4 STEM	Interactions
Foshay LC	LD C	CREATE 4 STEM	Interactions
James Monroe SH	LD NW	CREATE 4 STEM	Interactions
Legacy STEAM HS	LD E	CREATE 4 STEM	Interactions
Marquez School of Social Justice HS	LD E	CREATE 4 STEM	Interactions
Maya Angelou	LD C	CREATE 4 STEM	Interactions
Santee LC	LD C	CREATE 4 STEM	Interactions
Wilson HS	LD E	CREATE 4 STEM	Interactions
Canoga Park SH EV Mg	LD NW	BioZone	Supplemental Biology
Chavez Learning Academy - Teacher Prep Academy	LD NE	BioZone	Supplemental Biology
Cleveland CHS	LD NW	BioZone	Supplemental Biology
Contreras Social Justice	LD C	BioZone	Supplemental Biology
Crenshaw	LD W	BioZone	Supplemental Biology
Dymally HS	LD S	BioZone	Supplemental Biology
Grant HS	LD NE	BioZone	Supplemental Biology
Hawkins	LD W	BioZone	Supplemental Biology
Kennedy SH H/G Md Mg	LD NW	BioZone	Supplemental Biology
Manual Arts	LD C	BioZone	Supplemental Biology
Rancho Dominguez Preparatory	LD S	BioZone	Supplemental Biology
San Pedro	LD S	BioZone	Supplemental Biology

High School	Local District	Publisher	Pilot Program
Solis	LD E	BioZone	Supplemental Biology
Torres ELAPA	LD E	BioZone	Supplemental Biology
Chavez Learning Academy - Teacher Prep Academy	LD NE	BioZone	Supplemental Earth Science
Contreras Bus/Tourism	LD C	BioZone	Supplemental Earth Science
Dymally HS	LD S	BioZone	Supplemental Earth Science
Hamilton	LD W	BioZone	Supplemental Earth Science
Manual Arts	LD C	BioZone	Supplemental Earth Science
Marquez SSJ	LD E	BioZone	Supplemental Earth Science
Maywood Academy	LD E	BioZone	Supplemental Earth Science
Rancho Dominguez Preparatory	LD S	BioZone	Supplemental Earth Science
Reseda SH	LD NW	BioZone	Supplemental Earth Science
SOCES	LD NW	BioZone	Supplemental Earth Science
Sun Valley HS	LD NE	BioZone	Supplemental Earth Science

Local Districts

Local District Northeast: LD NE

Local District Northwest: LD NW

Local District East: LD E

Local District Central: LD C

Local District South: LD S

Local District West: LD W

Appendix E: Standards Organization

Elementary School

	Life Science	Earth & Space Science	Physical Science
	Elementary School Introduction		
K	Interdependent Relationships in Ecosystems: Animals, Plants, and Their Environment	Weather and Climate	Forces and Interactions: Pushes and Pulls
1	Structure, Function and Information Processing	Space Systems: Patterns and Cycles	Waves: Light and Sound
2	Interdependent Relationships in Ecosystems	Earth's Systems: Processes that Shape the Earth	Structure and Properties of Matter
	Grade K-2 Engineering Design		
3	Interdependent Relationships in Ecosystems Inheritance and Variation of Traits	Weather and Climate	Forces and Interactions
4	Structure, Function, and Information Processing	Earth's System: Processes that Shapes the Earth	Energy Waves: Waves and Information
5	Matter and Energy in Organisms and Ecosystems	Earth's systems Space Systems" Stars and the Solar System	Structure and Properties of Matter
	Grades 3-5 Engineering Design		

Middle School

Life Science	Earth and Space Science	Physical Science
Middle School Life Science Introduction	Middle School Earth & Space Science Introduction	Middle School Physical Science Introduction
Structure, Function, and Information Processing	Space Systems	Structure and Properties of Matter
Matter and Energy in Organisms and Ecosystem	History of Earth	Chemical Reactions
Interdependent Relationships in Ecosystems	Earth's systems	Forces and Interactions
Natural Selection and Adaptations	Weather and Climate	Energy
Growth, Development, and Reproduction of Organism	Human Impacts	Waves and Electromagnetic Reaction
Middle School Engineering Design		

High School

Life Science	Earth and Space Science	Physical Science
High School Life Science Introduction	High School Earth & Space Science Introduction	High School Physical Science Introduction
Structure and Function	Space System	Structure and Properties of matter
Inheritance and Variation of Traits	History of Earth	Chemical Reactions
Matter and Energy in Organisms and Ecosystems	Earth's System	Forces and Interactions
Interdependent Relationships in Ecosystem	Weather and Climate	Energy
Natural Selection and Evolution	Human Sustainability	Waves and Electromagnetic Radiation
High School Engineering Design		

Resources

Next Generation Science Standards Resources

Los Angeles Unified School District Science Webpage

http://achieve.lausd.net/science

- Web Resources
- NGSS Implementation Timeline
- California Implementation Timeline (CSTA)
- News and Announcements
- State Assessments

Los Angeles Unified School District STEAM Webpage

https://achieve.lausd.net/steam

- Web Resources on STEM/STEAM
- News and Announcements

General Information NGSS

- A New Vision for K-12 Science Education Video https://www.teachingchannel.org/videos/next-generation-science-standards-achieve
- The NGSS Official Website http://www.nextgenscience.org/

California NGSS Framework

California becomes the first state in the nation to adopt a Science Framework based on Next Generation Science Standards and is now poised to lead the nation in rolling out a rich, updated, 21st century science curriculum. The Science Framework provides guidance to teachers, administrators, and textbook publishers for the teaching of the Next Generation Science Standards from transitional kindergarten through twelfth grade. http://www.cde.ca.gov/nr/ne/yr16/yr16rel77.asp

California NGSS Assessment Plan

The new science assessment will be known as CAST – California Science Test. The alternate science assessment will be known as CAAS – California Alternate Assessment for Science. Both CAST and CAAS will be administered in grades 5, 8, and once in grades 10-12. The decision on when to administer the operational high school level science assessment will be local choice. The CAST assessment will be computer-based and should take no more than two hours to complete. The CAAS will be classroom-based and embedded.
http://www.cascience.org/ngss/assessments

Middle Grades and NGSS Middle School Instructional Progression

Los Angeles Unified School District has selected the Preferred Integrated Model for science in middle grades.
https://www.dropbox.com/sh/5x738rqckhka21y/AAAhmzzOQKfwQdWvia0lO66Ka?dl=0

CA NGSS- Preferred Integrated Model

The Division of Instruction is conducting a curriculum pilot in all middle schools. For more information visit this webpage: http://achieve.lausd.net/Page/4973

Secondary NGSS Units

The Secondary Science Leadership Team (a group of teacher leaders) developed NGSS aligned instructional units for middle and high school science courses.
http://achieve.lausd.net/science

Acknowledgements

Our special thanks is extended to those who have contributed to this document and have demonstrated their commitment to providing all students access to rigorous science instruction that will prepare students for college, career, and life. In addition, this work supports the belief that all students in LAUSD, with the implementation of the California Next Generation Science Standards, will engage in authentic, scientific, and engineering learning experiences that will develop scientifically literate and skilled critical thinkers to solve real life problems.

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Christopher Downing, Superintendent, Local District South

Joseph Nacorda, Superintendent, Local District Northwest

Dr. Gary Garcia, Principal, Marshall High School

Pedro Garcia, Administrator of Instruction, Local District South

Dr. Frances Gipson, Chief Academic Officer

Patricia Heideman, Administrator, High School Instruction

Jose Huerta, Superintendent, Local District East

Glendar Haskin, Former Science Specialist, Local District West

Cheryl Hildreth, Superintendent, Local District West

Judith Iguina, Specialist, Multilingual Multicultural Education Department

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Ivette Munoz, Specialist, Multilingual Multicultural Education Department

Natividad Rozsa, Administrator of Instruction, Local District Central
Jaspreet Sandha, STEAM Coordinator, Division of Instruction
Heinrich Sartin, STEAM Coordinator, Local District Northeast
Dina Sim, Administrator of Instruction, Local District Northwest
Christopher Sims, STEAM Expert, Local District Northwest
Craig Sipes, STEAM Coordinator, Local District East
Eduardo Solorzano, Administrator, Middle Grades Instruction
Lillian Valadez-Rodela, Elementary Science Coordinator, Division of Instruction
Dr. Darnise Williams, Administrator of Instruction, Local District West

In addition to the above individuals, we would like to thank the following departments for their collaboration in this and future work around the California Next Generation Science Standards:

Access, Equity and Acceleration
Instructional Technology Initiative
Linked Learning
Multilingual/Multicultural Education Department
Parent and Community Services
Special Education Division