Implementing NGSS in Oakland & San Francisco

February 1, 2016

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Sarah Delaney, San Francisco USD

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Who are You?
HELLO
my name is
Caleb Cheung

HELLO
my name is
Sarah Delaney
Goals

1. Identify NGSS challenges
2. Share NGSS implementation efforts
3. Exchange NGSS tools & resources
Agenda

Introduction
NGSS Challenges
San Francisco
Oakland
Questions & Comments
Turn & Talk

What made you decide to attend this session?
Challenges
NEXT GENERATION
SCIENCE
STANDARDS
Conceptual Shifts

1. Real world science interconnections
2. Builds coherently across K-12
3. Focuses on deeper understanding and application of content
4. Integrates science and engineering
5. Aligns with Common Core State Standards
6. Focuses on 3 dimensional performance expectations
7. Prepare students for college, career, and citizenship
<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>NGSS Adopted</td>
</tr>
<tr>
<td>2014</td>
<td>Framework Committee</td>
</tr>
<tr>
<td>2016</td>
<td>Framework Finalized</td>
</tr>
<tr>
<td></td>
<td>Assessment Pilot</td>
</tr>
<tr>
<td>2017</td>
<td>Assessment Field Test</td>
</tr>
<tr>
<td>2018</td>
<td>Assessment Implementation</td>
</tr>
<tr>
<td></td>
<td>Instructional Materials Adoption</td>
</tr>
</tbody>
</table>
Structural Constraints

1. Instructional Time
2. Math/Science Coring
3. Coordination with Academies
Challenges

1. Conceptual Shifts
2. Heterogeneous Teaching Force
3. Funding
4. Timeline
5. Structural Constraints
San Francisco
57,000 Students

131 Schools

- 12 Early Ed
- 71 K-5 & K-8
- 12 Middle
- 15 High
- 21 Alternative & Charter
27% English Learner

53% Free/Reduced Lunch

10 FTE supporting science district-wide
Strengthening STEM Education Through Local Control: A Toolkit to Help Develop Your District's Local Control Accountability Plan (LCAP)

This toolkit has been assembled by California STEM Learning Network (CSLNet), together with the Lawrence Hall of Science at the University of California, Berkeley, to help parents, students, educators, community partners and business leaders who are concerned about improving Science, Technology, Engineering and Math (STEM) education to participate in their local school district budget development process. As explained in our LCAP Primer, recent changes in California law have given school districts more control and flexibility over how to spend state education funds, while also requiring new levels of transparency and accountability through the creation of Local Control and Accountability Plans (LCAPs). This toolkit helps STEM advocates understand how the LCAP development process works and how to participate in it. More importantly, it guides stakeholders to identify specific recommendations for strengthening STEM within their districts and translating those recommendations into the format of an LCAP.

High-quality STEM education encompasses both rigorous instruction in the individual disciplines of science, technology, engineering and mathematics, as well as integrated approaches that weave two or more of these subjects together — like they are in the real-world practice of science and engineering. California’s commitment to implement new standards for math and science — the Common Core State Standards for Math (CCSS-M) and the Next Generation Science Standards (NGSS) — provides the biggest opportunity in decades to bring high-quality STEM education to all students.

Because there are more existing resources focused on implementation of the Common Core State Standards, and in an effort to get information into the field before the end of the 2015-16 LCAP development period, this beta version of the toolkit focuses largely on science education and implementation of the NGSS. It also aims to highlight new content and opportunities within the NGSS to strengthen STEM education through instruction in engineering design, environmental literacy and computational thinking, as well as linkages to informal education. A second version of the toolkit, scheduled for fall 2015 release, will contain additional tools and examples of promising practices, including greater focus on math.
NEXT GENERATION
SCIENCE
STANDARDS
SFUSD NGSS Implementation

1. Teacher Leaders
SFUSD NGSS Implementation

1. Teacher Leaders
2. High School Course Decisions
### ESS 1: Earth's Place In The Universe

<table>
<thead>
<tr>
<th>Physics</th>
<th>Chemistry</th>
<th>Biology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ess 1-1</td>
<td></td>
<td></td>
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<tr>
<td>Ess 1-2</td>
<td></td>
<td></td>
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<td>Ess 1-3</td>
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<td>Ess 1-4</td>
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<td>Ess 1-5</td>
<td></td>
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<tr>
<td>Ess 1-6</td>
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</tbody>
</table>

### ESS 2: Earth's System's

<table>
<thead>
<tr>
<th>Physics</th>
<th>Chemistry</th>
<th>Biology</th>
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</thead>
<tbody>
<tr>
<td>Ess 2-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ess 2-2</td>
<td>Albedo</td>
<td></td>
</tr>
<tr>
<td>Ess 2-3</td>
<td>Thermo</td>
<td></td>
</tr>
<tr>
<td>Ess 2-4</td>
<td>Climate</td>
<td></td>
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<tr>
<td>Ess 2-5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ess 2-6</td>
<td>Carbon</td>
<td></td>
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<tr>
<td>Ess 2-7</td>
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</tr>
</tbody>
</table>

### ESS 3: Earth + Human Activity

<table>
<thead>
<tr>
<th>Physics</th>
<th>Chemistry</th>
<th>Biology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ess 3-1</td>
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<tr>
<td>Ess 3-2</td>
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<td>Ess 3-3</td>
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<td>Ess 3-4</td>
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<td>Ess 3-5</td>
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<tr>
<td>Ess 3-6</td>
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</tbody>
</table>

Additional notes:
- ESS 2-2: Albedo
- ESS 2-4: Climate, eco
- ESS 3-4: White, black, pink
- All: Green, yellow

- Climate systems predict a linear relationship between climate and human activity.
## Primary 9th Grade Course by School

<table>
<thead>
<tr>
<th>Biology</th>
<th>Conceptual Physics</th>
<th>Biotech 1</th>
<th>Earth Science</th>
<th>Physiology</th>
<th>Field Biology</th>
</tr>
</thead>
<tbody>
<tr>
<td>O’Connell (Marine Biology prior to 2014/15)</td>
<td>Academy</td>
<td>Marshall</td>
<td>Burton</td>
<td>International</td>
<td>June Jordan</td>
</tr>
<tr>
<td>Galileo</td>
<td>Balboa</td>
<td></td>
<td></td>
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<tr>
<td>Independence</td>
<td>Mission</td>
<td></td>
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<tr>
<td>Lincoln</td>
<td>ISA</td>
<td></td>
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</tr>
<tr>
<td>Lowell</td>
<td>SOTA</td>
<td></td>
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<tr>
<td>Wallenberg</td>
<td></td>
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<tr>
<td>Washington</td>
<td></td>
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</tr>
</tbody>
</table>

### Number of Students 2014-2015

<table>
<thead>
<tr>
<th></th>
<th>Biology</th>
<th>Physics</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014-2015</td>
<td>2395</td>
<td>796</td>
<td>533</td>
</tr>
</tbody>
</table>
High School Course Sequence

9th Grade Physics
9th/10th Grade Life Science
10th/11th Grade Chemistry
10th/11th Grade Physics

Earth Science, Space Science and Engineering Standards embedded in each course.
SFUSD NGSS Implementation

1. Teacher Leaders
2. High School Course Decisions
3. A Core Curriculum for Science
SFUSD NGSS Implementation

1. Teacher Leaders
2. High School Course Decisions
3. A Core Curriculum for Science
4. Professional Development
SFUSD NGSS Implementation

1. Teacher Leaders
2. High School Course Decisions
3. A Core Curriculum for Science
4. Professional Development
5. Science Resource Center & Material Management System
SFUSD NGSS Implementation

1. Teacher Leaders
2. High School Course Decisions
3. A Core Curriculum for Science
4. Professional Development
5. Science Resource Center & Material Management System
6. Access & Equity
San Francisco is a fully networked ecosystem of learning where education happens everywhere, in both formal and informal learning environments.
Oakland
Support Teachers
## Elem Site-Based PD

<table>
<thead>
<tr>
<th>Introductory Series</th>
<th>Notebooking Series</th>
<th>Literacy Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nuts &amp; Bolts of FOSS</td>
<td>Introduction to Notebooking</td>
<td>Science Writing</td>
</tr>
<tr>
<td>Fitting In FOSS: Science &amp; Classroom Management</td>
<td>Notebooking Next Steps: Applied, with FOSS</td>
<td>Developing Language through Science Instruction</td>
</tr>
<tr>
<td></td>
<td>Advanced Notebooking</td>
<td>Oral Discourse in Science</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Science Fair Series</th>
<th>Assessment Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction to Science Fair</td>
<td>Assessment in Science: An Overview</td>
</tr>
<tr>
<td>Honing the Research Question</td>
<td>FOSS Assessment Tools</td>
</tr>
<tr>
<td>Organizing Science Fairs (for the Planning Team)</td>
<td>Looking at Student Work</td>
</tr>
</tbody>
</table>
Nurture Leadership
Nurture Leadership

1. Teacher Leaders
2. Principals
3. Central District
OUSD
Principal
Science
Professional Development
OUSD Science Vision

All Oakland students will graduate science literate with the skills needed to succeed in college, career and community.
Improving Elementary Science Instruction
In the Oakland Unified School District

Improving education in math and science is... about expanding opportunity for all Americans in a world where an education is the key to success. It’s about an informed citizenry in an era where many of the problems we face as a nation are, at root, scientific problems. And it’s about the power of science to not only unlock new discoveries, but to unlock in the minds of our young people a sense of promise, a sense that with some hard work -- with effort -- they have the potential to achieve extraordinary things.

- President Barack Obama, remarks on the Education to Innovate campaign on November 23, 2009

All students will graduate as caring, competent and critical thinkers, fully informed, engaged and contributing citizens, prepared to succeed in college and career.

-Oakland Unified School District Vision 2009
# Elementary Science Continuum

## Key Dimensions

### I. Vision & Reality

#### Communication
- **Beginning**: Lead Science Teacher (LST) misses meetings and fails to communicate with Science Department and colleagues.
- **Implementing**: LST attends all meetings and communicates regularly with staff and principal.
- **Integrating**: LST has a system for direct communication with teachers.
- **Innovating**: Teachers and principals seek out communication with LST.

#### Principal Leadership
- **Beginning**: Science is de-prioritized, principal does not take ownership of the science program, and/or does not include science on the master schedule.
- **Implementing**: Principal remains informed and involved with the science program. Site leadership team addresses science. Science is a part of the master schedule and site plan.
- **Integrating**: Grade level meetings focus on science once a month (PLCs).
- **Innovating**: Science is a major focus area for the school. Examples include school science events, fundraisers, field trips, regular PD.

#### Teacher Leadership
- **Beginning**: Only the Lead Science Teacher is responsible for science implementation.
- **Implementing**: Instructional leadership team is responsible for science implementation and PD.
- **Integrating**: Science leadership occurs each grade level/PLC.
- **Innovating**: Teachers peer coach and present PD.

### II. Leadership Capacity

#### Systems Improvement (FOSS Kits)
- **Beginning**: Inconsistent kit distribution to classrooms, materials inventories, preparedness for rotation, and communication to all teachers about science opportunities.
- **Implementing**: Consistent FOSS kit distribution, inventory, and rotation. Reliance on LST for all work and regular communication to teachers at site.
- **Integrating**: All teachers take responsibility for kit preparedness. Principal supports time for kit inventory and science communication.
- **Innovating**: Volunteers and community members assist with rotation and kit inventory.

#### Professional Development (PD)
- **Beginning**: Little or no science professional development (PD).
- **Implementing**: All teachers have completed Intro to FOSS or Nuts and Bolts PD. Teachers are working on improving group management and materials.
- **Integrating**: Teachers are focusing on Science Notebooks and other more advanced practices (Academic Language, English Language Learners).
- **Innovating**: Teachers are building site capacity for leading professional development and sharing work with other sites.

### III. Instructional Capacities

#### Instructional Time
- **Beginning**: Inconsistent time and quality of science instruction.
- **Implementing**: Hands-on FOSS science is taught weekly for 60 minutes (K-2) and 90 minutes (3-5) per Board policy.
- **Integrating**: Science instruction exceeds Board policy.
- **Innovating**: Science instruction exceeds Board policy and science program includes out-of-school time.
To: K-12 Principals and Teachers  
From: Devin Dillon, Chief Academic Officer  
        David Chambliss, Deputy Chief of Teaching and Learning  
        Caleb Cheung, Manager of Science  
CC: Allen Smith, Chief of Schools  
        Network Superintendents  
Date: September 2, 2015  
Re: Science CST Context

This memo addresses the changing context of Science education in Oakland and deemphasizes the role of Science California Standards Tests (CST) at grades 5, 8, and 10.

In 2013, the California Department of Education (CDE) adopted the Next Generation Science Standards (NGSS) as the new state science standards. NGSS are radically different from the previous California Science Standards, requiring a different set of practices, skills, and pedagogical strategies. The scope and sequence of content has drastically changed throughout K-12 compared to the previous standards over the K-12 instructional sequence.

OUSD started a transition to NGSS two years ago and has a goal of full implementation for the 2017-18 school year. There are now districtwide expectations to begin instructional and resource alignment. During the 2015-16 school year, all 3rd and 4th grade teachers are implementing the Science Instructional Reflection and Assessment (SIRA) with their FOSS kits. Additionally, the 5th grade SIRA’s are being piloted at interested sites. The three middle school grades and 9th grade Biology are using NGSS aligned lessons and summative tasks.

However, due to federal regulations, California is still mandated to administer the CSTs in science at grades 5, 8, and 10. These assessments are developed from the previous standards and not aligned to NGSS. According to the CDE, “because the current science tests are not aligned with the new CA NGSS, the results will not be used in any accountability reports; however, the scores will be publicly available.”
Reflective Assessment Protocol

Conceptual Framework

Planning

Learning Objectives

Focus Questions

Instruction

Science Talks

Science Notebooks

Formative Assessment

End-of-Module Assessment

Reflective Assessment Protocol

Science Talk Checklist
<table>
<thead>
<tr>
<th>Grade</th>
<th>Cross cutting concepts</th>
<th>Life</th>
<th>Earth and Space</th>
<th>Physical</th>
<th>Human Impact</th>
<th>Engineering</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>Stability and change; scale, proportion and quantity</td>
<td>Natural Selection</td>
<td>History of the Earth Space systems</td>
<td>Waves and Electromagnetic Radiation Energy Forces and Interactions</td>
<td>Human Impact</td>
<td>ETS</td>
</tr>
<tr>
<td>7</td>
<td>Energy and Matter: flows, cycles, and conservation; cause and effect</td>
<td>Ecosystems</td>
<td>Natural resources</td>
<td>Structure and Property of Matter</td>
<td>Human Impact</td>
<td>ETS</td>
</tr>
<tr>
<td>6</td>
<td>Patterns; structure and function; systems and system models</td>
<td>Cells and Organisms</td>
<td>Weather and climate</td>
<td>Energy</td>
<td>Human Impact</td>
<td>ETS</td>
</tr>
<tr>
<td>5</td>
<td>Energy and Matter: flows, cycles and conservation; Scale, proportion and quantity</td>
<td>Matter cycles through living and non living things</td>
<td>Earth in space, interactions of earth systems</td>
<td>Properties and structure of matter</td>
<td>Human Impact</td>
<td>ETS</td>
</tr>
</tbody>
</table>
### Curriculum Anatomy

<table>
<thead>
<tr>
<th>Unit</th>
<th>Semester 1</th>
<th>Semester 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Launch Unit</td>
<td>Unit 1</td>
<td>Unit 2</td>
</tr>
<tr>
<td>ET</td>
<td>LT</td>
<td>ST</td>
</tr>
<tr>
<td><strong>ET = Entry Task</strong></td>
<td>Students engage in Unit Theme and Storyline and are introduced to the Summative Task</td>
<td></td>
</tr>
<tr>
<td><strong>LT = Learning Task</strong></td>
<td>Students participate in formative learning experiences that scaffold up to the ST</td>
<td></td>
</tr>
<tr>
<td><strong>ST = Summative Task</strong></td>
<td>Students demonstrate understandings with a cumulative Authentic Performance Task</td>
<td></td>
</tr>
</tbody>
</table>

#### Task Components

- **Teacher Information**
  - Teacher Overview
  - Multimedia
  - References
- **Student Handouts**
  - Task Cards
  - Output Sheets
  - Resource Pages
  - Rubrics
- **Shared Resources**
  - Supplementary Materials
  - Student Work Samples

### Curriculum Examples

<table>
<thead>
<tr>
<th>Grade</th>
<th>Unit</th>
<th>Entry Task</th>
<th>Sample Learning Task</th>
<th>Summative Task</th>
</tr>
</thead>
</table>
| 6     | Launch Unit: Like an Engineer | ET: Building a Tower  
How can failure lead to innovation? | LT 1: What Happened Here?  
What caused structures to fail and how can they be fixed? | ST: Building a Bridge  
How does failure lead to innovation? |
| 7     | Unit 1: Global Water Crisis | ET: Time of Drought  
How are scientists cleaning our water to address the drought? | LT 3: Desalination Engineering  
How can we convert seawater to potable fresh water using solar energy? | ST: Engineers Without Borders  
How does science enable communities to gather clean water? |
| 8     | Unit 3: Space & Gravity | ET: Packing for Space  
What is gravity and how does it impact life? | ST: To The Moon!  
How might we design and power a one way flight plan to the moon? |
| Bio9  | Unit 2: Food for Thought | ET: Food Log  
Can a nutrition label change a teenager’s eating habits? | LT 4: Macromolecules  
What does it mean to say “you are what you eat”? | ST: Food Choices Infographic  
How do our food choices impact our health and the environment? |
| Chem10 | Launch Unit: Magic or Science? | ET: Foiled Again  
What types of observations help us explain things we can’t see? | LT 4: SPARe Change  
How can we distinguish between physical and chemical changes? | ST: The Science of Alchemy  
How has science increased our ability to explain things we can’t see? |
Science 5x8 Card
Practices for High Quality K-12 Science Education

The Next Generation Science Standards (NGSS) define eight scientific and engineering practices for students as they engage in science learning. Not all practices will be evident every time, in every activity. Evidence of the practices exists through student activities and interactions. See reverse for student behaviors.

Scientific and Engineering Practices

1. Asking questions and defining problems
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations and designing solutions
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information
## K-12 Science Learning Principles and Actions

<table>
<thead>
<tr>
<th>Principles (Practices)</th>
<th>Vital Student Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Questions guide inquiry (1, 4, 8)</td>
<td>Students ask meaningful <strong>questions</strong> relevant to the science topic or lesson.</td>
</tr>
<tr>
<td>2. Learning occurs through investigations (1, 2, 3, 4, 5)</td>
<td>Students use materials, tools, and texts to <strong>explore</strong>, <strong>gather data</strong>, and <strong>answer questions</strong>.</td>
</tr>
<tr>
<td>3. Explanations are evidence-based (2, 4, 5, 6, 7, 8)</td>
<td>Students use evidence to <strong>interpret</strong> observations, <strong>support</strong> ideas, and <strong>construct</strong> explanations.</td>
</tr>
<tr>
<td>4. Science is a community endeavor that evolves with new evidence (4, 5, 6, 7, 8)</td>
<td>Students <strong>collaborate</strong> to build understanding and <strong>revise</strong> their thinking when presented with new evidence.</td>
</tr>
<tr>
<td>5. Application is essential for building understanding (1, 2, 3, 6)</td>
<td>Students <strong>apply</strong> science knowledge and practices to respond to open-ended and novel problems.</td>
</tr>
<tr>
<td>6. Academic success depends on academic language</td>
<td>Students use discipline-specific <strong>academic language, models</strong>, and <strong>mathematics</strong> to communicate understanding <strong>orally</strong> and in <strong>writing</strong>.</td>
</tr>
<tr>
<td>7. ELs develop language through content</td>
<td>English learners produce language that <strong>communicates</strong> ideas and reasoning, even when that language is imperfect.</td>
</tr>
<tr>
<td>8. Equitable participation</td>
<td>All students are <strong>engaged</strong> in learning and <strong>choose</strong> appropriate <strong>scaffolds</strong> for learning.</td>
</tr>
</tbody>
</table>
The OUSD elementary science program centers around the FOSS curriculum. FOSS kits are provided to all elementary school sites on a rotational basis every trimester. Live organisms and consumable materials will also be fully supplied. Below for details and resources related to the program.

Key Documents
- FOSS Kit Rotation Schedule 2013-14
- FOSS Implementation Guide/FAQ
- Elementary Science Calendar 2013-14 (deadlines, trainings and events)
- Live Organisms
- Professional Development
- Assessment
- Standards
- Safety & Equipment Maintenance

FOSS Curricular Resources
Teacher Guides
Electronic versions of the FOSS Teacher Guides are available from Lead Science Teachers.

FOSS Kit Rotation
- 2013 Fall FOSS Kit Drop Off Schedule (the rotation schedule for the rest of the year will be posted here in September)

Lead Science Teachers
Each school has a designate Lead Science Teacher (LST) to assist with the coordination and implementation of FOSS.
Oakland Science Partners
OLAS
Oakland Language Immersion Advancement in Science
Thank You!
tinyurl.com/stemsmartngss
science.ousd.org
sfusdscience.org
nextgenscience.org
Thank You!