

# Building Elementary Science Teaching

Summer Institute 2018:  
Investigations in life sciences

June 18-22, 2018 9:00-3:30 Richmond CA



**THE LAWRENCE  
HALL OF SCIENCE**  
UNIVERSITY OF CALIFORNIA, BERKELEY

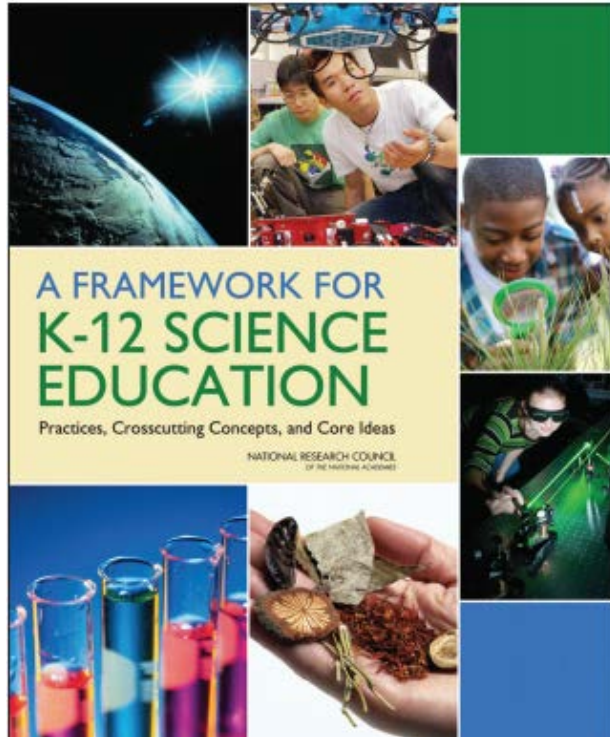
# Goals

- Expand use of NGSS 3-dimensional learning strategies
- Explore how to effectively develop and support science learning for all students
- Building literacy skills through science
- Use the outdoors for scientific exploration and investigation

# Monday's agenda






- Intro
- NGSS review
- CROSSCUTTING CONCEPTS
- Plant investigations
- Lunch
- More plant investigations

# From inquiry to practices



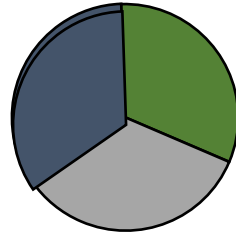
K-12 science education should reflect the interconnected nature of science as it is practiced and experienced in the real world

# Shifting to an NGSS approach

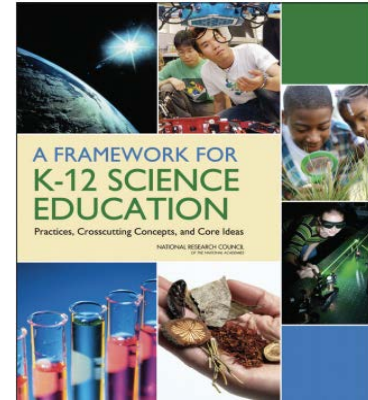
|                              |  |  |
|------------------------------|--|--|
| from science inquiry only    |    | to a broader view of science practices |
| from learning about          |    | to figuring out                        |
| from knowing a list of ideas |    | to knowing how ideas fit together      |
| from simple explanations     |  | to more complex explanations           |
| from knowing that            |  | to knowing why or how                  |

# Science

Next Generation



Standards



## A New Vision for Teaching and Learning

Science for ALL Students

Three Dimensional Coherent Learning across Grades

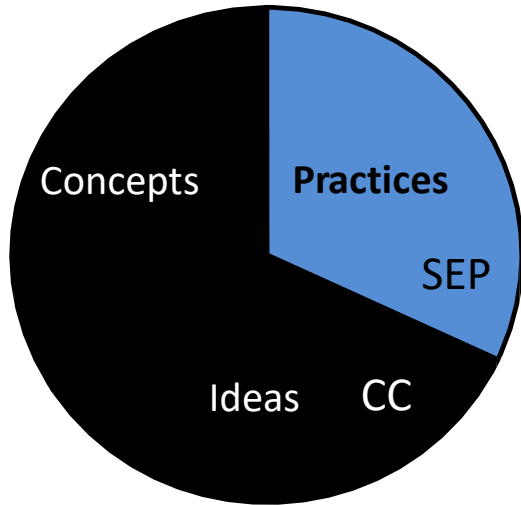
8 Science and Engineering  
Practices

7 Crosscutting  
Concepts

### Disciplinary Core Ideas

- Physical Sciences
- Life Sciences
- Earth and Space Sciences
- Engineering, Technology, and Applications of Science

# 8 Science and Engineering Practices



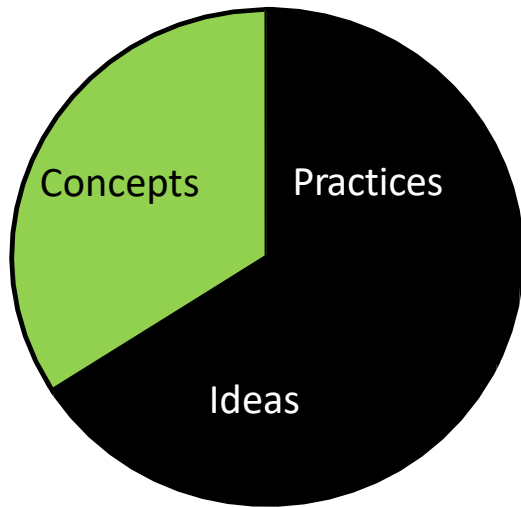
Knowledge

Skills

What is required to do science or engineering

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. Developing explanations and designing solutions
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

## 7 Crosscutting Concepts



**Fundamental**

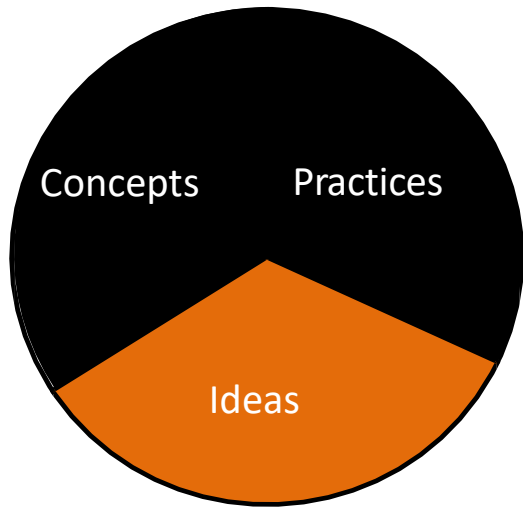
**Bridge**

Fundamental concepts that bridge all the ideas

- 1. Patterns** – organization and classification
- 2. Cause and effect** – mechanism and explanation
- 3. Scale, proportion, and quantity** - recognize what is relevant
- 4. Systems and system models** – define the system under study
- 5. Energy and matter** - flows, cycles and conservation
- 6. Structure and function** – determine properties of things
- 7. Stability and change** – determine rate of change or evolution



# Disciplinary Core Ideas



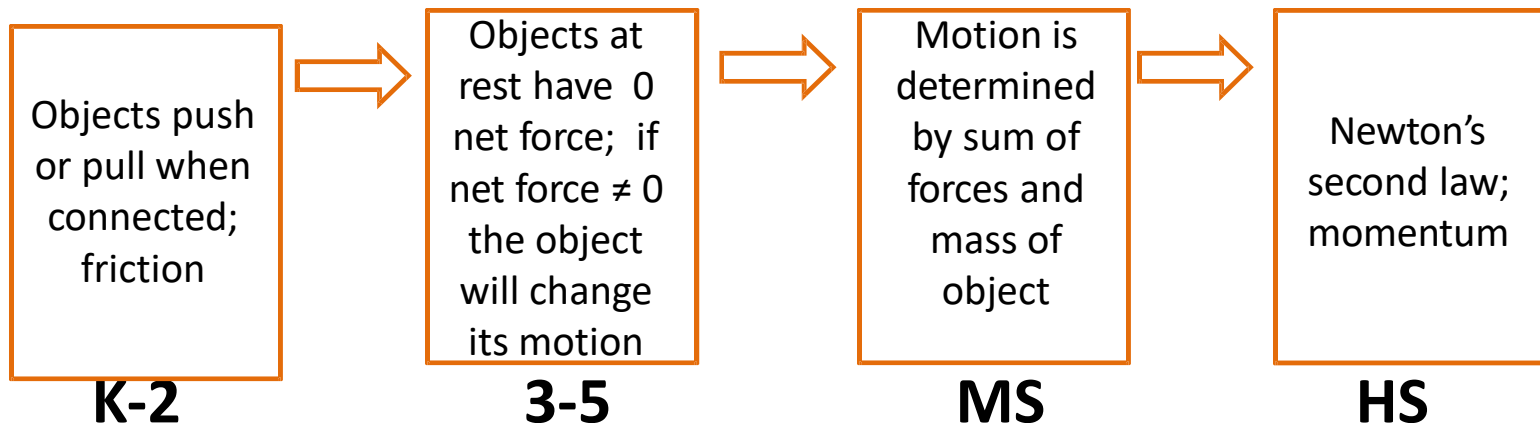
## Content

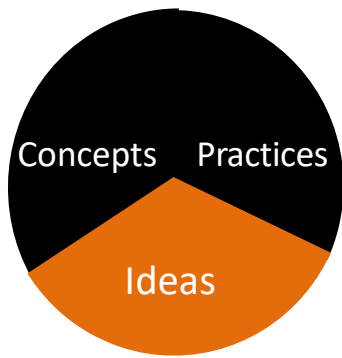
## Progression

What to teach and how to lead students through the material

- Sciences (Chemistry and Physics)
- Life Sciences
- Earth and Space Sciences
- Engineering, Technology, & Applications of Science

## PS2.A – Forces and Motion





# Disciplinary Core Ideas K-12

**Content**

**Progression**

## Life Science

- LS1: From Molecules to Organisms: Structures and Processes
- LS2: Ecosystems: Interactions, Energy, and Dynamics
- LS3: Heredity: Inheritance and Variation of Traits
- LS4: Biological Evolution: Unity and Diversity

## Physical Science

- PS1: Matter and Its Interactions
- PS2: Motion and Stability: Forces and Interactions
- PS3: Energy
- PS4: Waves and Their Applications in Technologies for Information Transfer

## Earth & Space Science

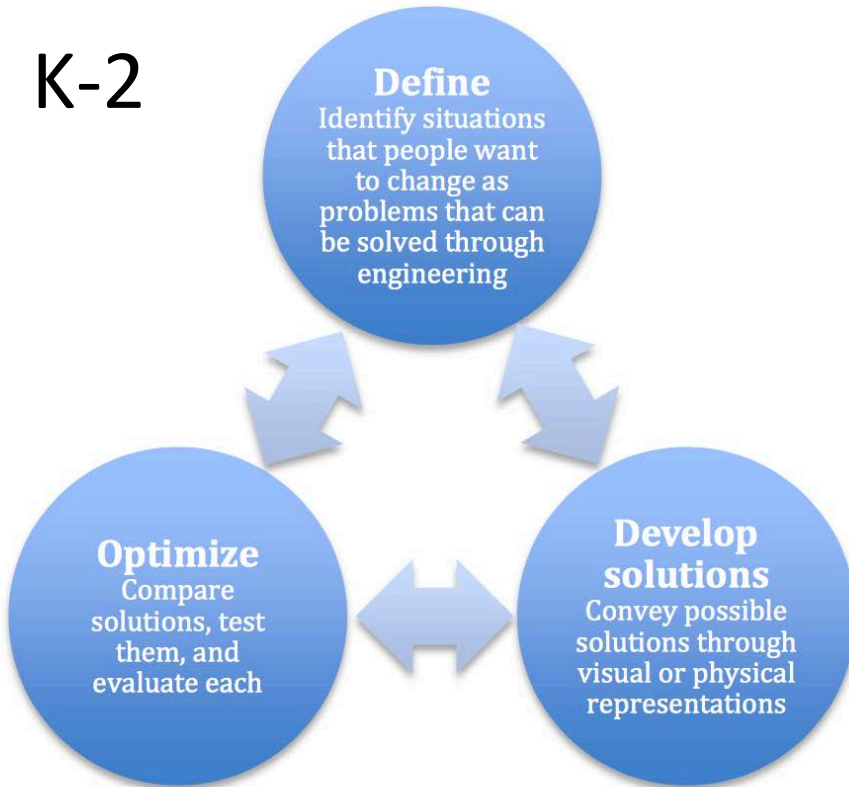
- ESS1: Earth's Place in the Universe
- ESS2: Earth's Systems
- ESS3: Earth and Human Activity

## Engineering & Technology

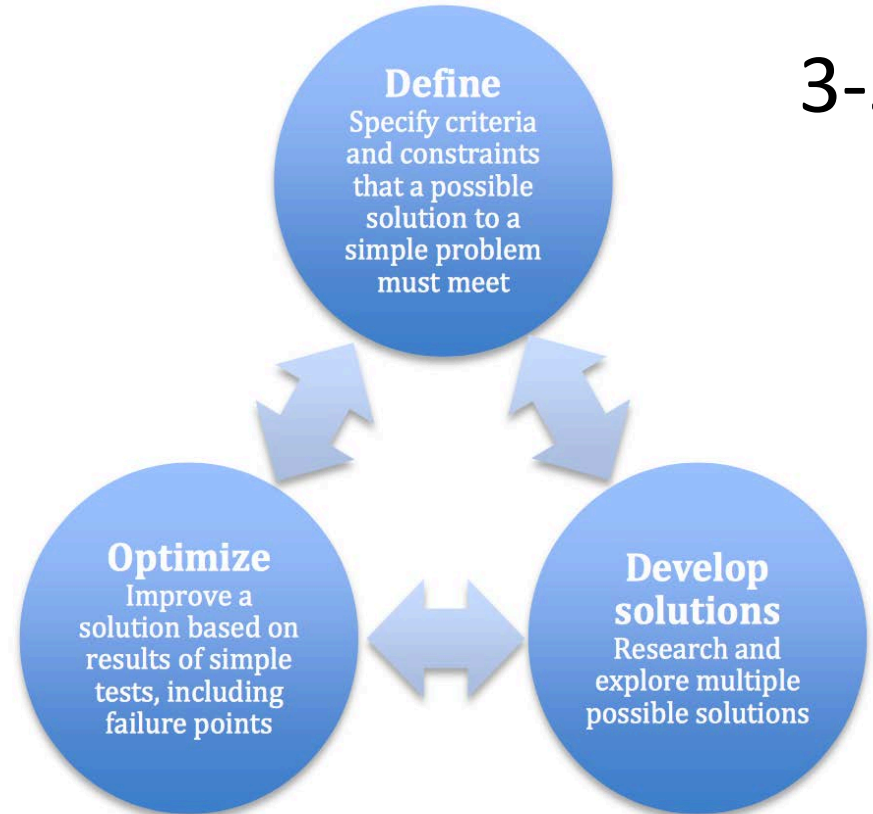
- ETS1: Engineering Design
- ETS2: Links Among Engineering, Technology, Science, and Society

# Engineering Design Process

K-2



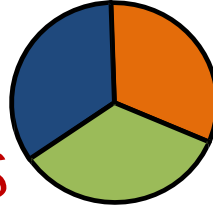
3-5



**To experience failure does not mean you've failed... It is part of the process.**

# What is the “Standard”?

## Next Generation Science Standards



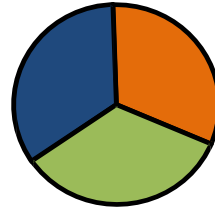
“NSTA recommends that ‘the standard’ be defined as the combination of the **performance expectations** and the contents of the **foundation boxes**.

|   |  |  |
|---|--|--|
| <b>5-ESS3-1 Earth and Human Activity</b>  |  |  |
| Students who demonstrate understanding can:   |  |  |
| 5-ESS3-1. Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.  |  |  |
| The performance expectation above was developed using the following elements from the NRC document <i>A Framework for K-12 Science Education</i> :  |  |  |
| <b>Obtaining, Evaluating, and Communicating Information</b><br><br>Obtaining, evaluating, and communicating information in 3–5 builds on K–2 experiences and progresses to evaluating the merit and accuracy of ideas and methods. <ul style="list-style-type: none"><li>Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem.</li></ul> | <b>ESS3.C: Human Impacts on Earth Systems</b> <ul style="list-style-type: none"><li>Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments.</li></ul> | <b>Systems and System Models</b> <ul style="list-style-type: none"><li>A system can be described in terms of its components and their interactions.</li></ul> -----<br><b>Connections to Nature of Science</b><br><br><b>Science Addresses Questions About the Natural and Material World.</b> <ul style="list-style-type: none"><li>Science findings are limited to questions that can be answered with empirical evidence.</li></ul> |
| Connections to other DCIs in fifth grade: N/A   |  |  |
| Articulation of DCIs across grade-levels: MS-ESS3-A, MS-ESS3-C, MS-ESS3-D   |  |  |

- All **Performance Expectations** (PEs) and **Foundation Boxes** are rooted in the framework

# Next Generation Science Standards

# Performance Expectations



What students should ***be able to do*** after a learning sequence.

| 5-ESS3-1 Earth and Human Activity   |  |  |
|---|--|--|
| Students who demonstrate understanding can:   |  |  |
| 5-ESS3-1. Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.  |  |  |
| The performance expectation above was developed using the following elements from the NRC document <i>A Framework for K-12 Science Education</i> :  |  |  |
| <b>Obtaining, Evaluating, and Communicating Information</b><br><br>Obtaining, evaluating, and communicating information in 3–5 builds on K–2 experiences and progresses to evaluating the merit and accuracy of ideas and methods. <ul style="list-style-type: none"><li>Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem.</li></ul> | <b>ESS3.C: Human Impacts on Earth Systems</b> <ul style="list-style-type: none"><li>Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments.</li></ul> | <b>Systems and System Models</b> <ul style="list-style-type: none"><li>A system can be described in terms of its components and their interactions.</li></ul> -----<br><b>Connections to Nature of Science</b><br><b>Science Addresses Questions About the Natural and Material World.</b> <ul style="list-style-type: none"><li>Science findings are limited to questions that can be answered with empirical evidence.</li></ul> |
| Connections to other DCIs in fifth grade: N/A   |  |  |
| Articulation of DCIs across grade-levels:<br>MS.ESS3.A : MS.ESS3.C : MS.ESS3.D  |  |  |

- Guides the writing of state assessment.
- Not a curriculum.

# Anatomy and Architecture of a NGSS Standard

MS-PS2-2

Grade Level/Band

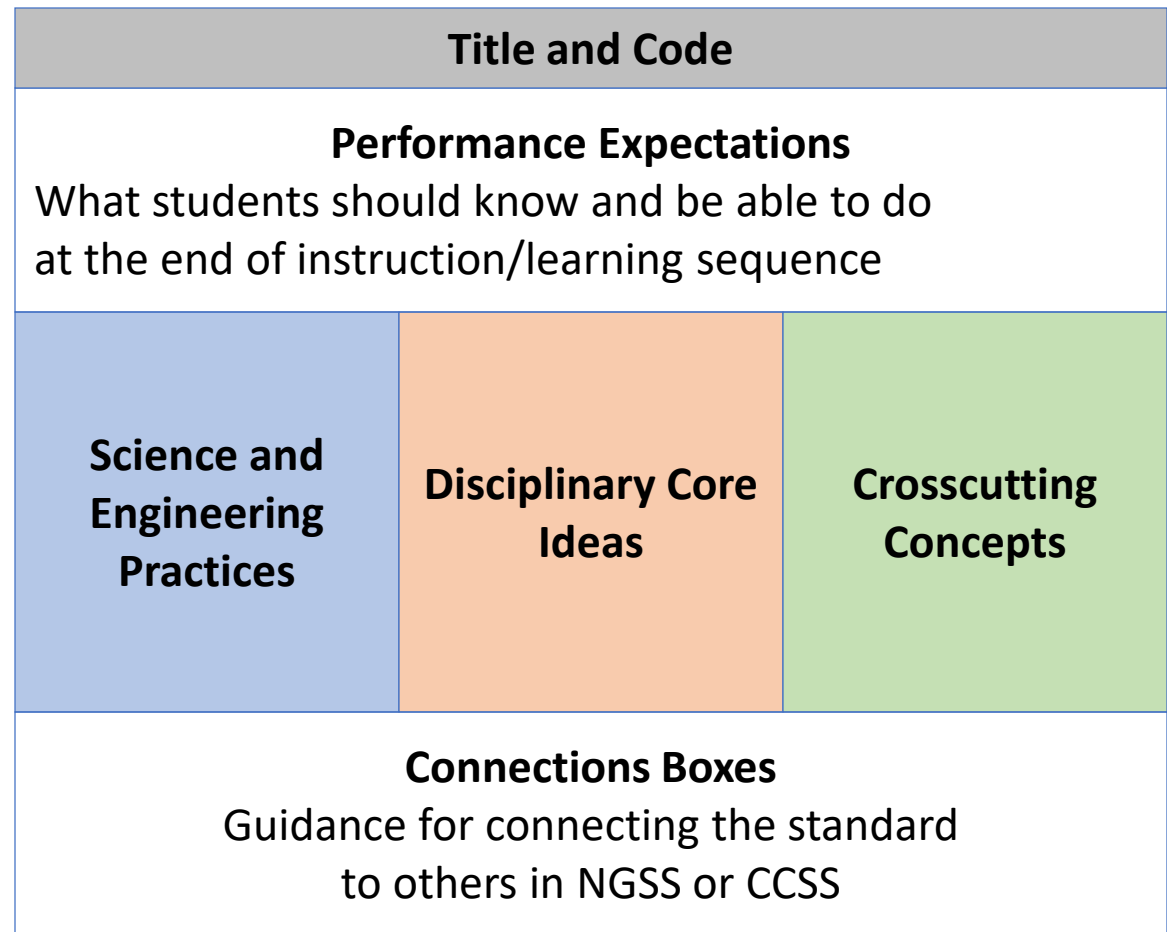
DCI

PE#

Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.



Foundation Boxes



The CDE recommends that the State Board of Education (SBE) approve the grades for which the CA NGSS summative assessments will be administered and recommends that the SBE approve the development of three online CA NGSS summative assessments to meet the requirements of the Every Student Succeeds Act and *EC* Section 60640(b)(2)(B) consistent with the proposed test design in Attachment 1:

- **Grade five assessment, consisting of grade five performance expectations and matrix sampling of performance expectations from kindergarten through grade four;**
- **Grade eight assessment, consisting of middle school (grades six through eight) performance expectations;**
- Grade ten, eleven, or twelve assessment, consisting of high school performance expectations.