Next Generation Science in the Garden

Monday, September 28, 2015

Presented by Whitney Cohen
Education Director, Life Lab & Lecturer, UC Santa Cruz

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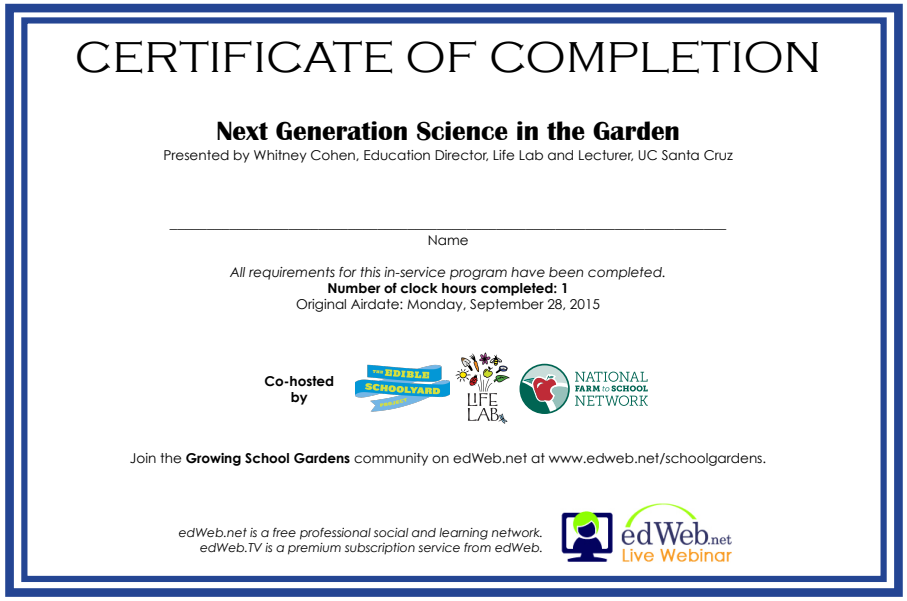

CERTIFICATE OF COMPLETION

Next Generation Science in the Garden

Presented by Whitney Cohen, Education Director, Life Lab and Lecturer, UC Santa Cruz

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Name

All requirements for this in-service program have been completed.
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How Can We Use a Garden to Support Students in Pursuing Next Generation Science?

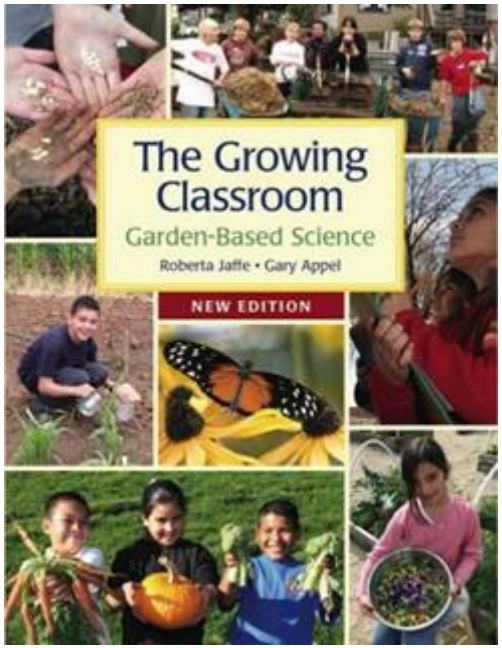
Agenda

- Introductions
- Understanding the 3 Strands of NGSS
- Opportunities to Use the Garden to Support NGSS
- Example NGSS Activities in the Garden
- Resources to Help You Get Started

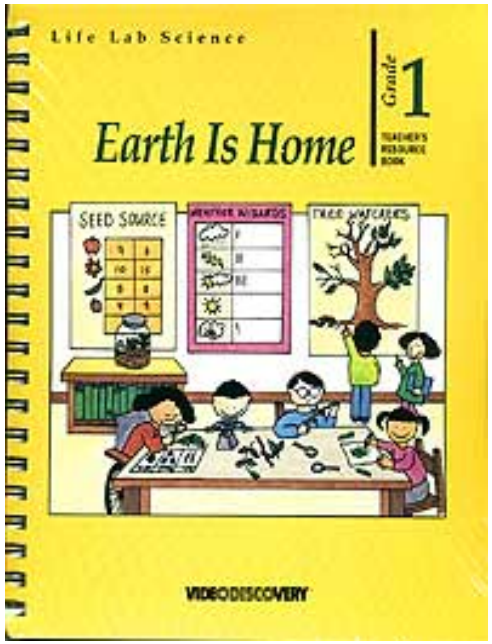
What Is Life Lab?

A California-based non-profit organization and national leader in farm- and garden-based education since 1979

We have field trips, summer camps, and a youth internship program in our Garden Classroom in Santa Cruz, CA.

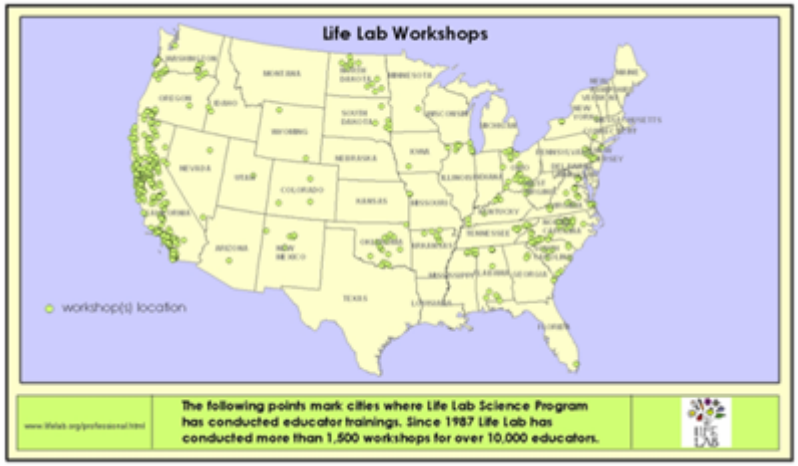


2007 New Edition *The Growing Classroom* Garden-Based Science Activity Guide



K - 5 Life Lab Science Curriculum

Materials to Support Garden-Based Learning



Books and Workshops

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Life Lab teaches people to care for themselves, each other, and the world through farm and garden-based programs.

SEARCH

Bring learning to life in the garden!

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upcoming events

- october 7 pigiei workshop
- november 5-6 growing classroom workshop
- november 18 next generation science workshop

Since 1979 Life Lab Science Program has supported science and garden-based education through publications, professional development, and innovative programs.

we are a proud state host

Common Core and Next Generation Science in the Garden

<< Saving Water in the Garden | | How Do Schools Compost? >>

Here at Life Lab, we have cross-mapped every lesson in The Growing Classroom with the new Common Core Math and Language Arts standards and Next Generation Science Standards (NGSS) being rolled out in schools across the country! We've also cross-mapped every lesson in Sowing the Seeds of Wonder with California's Preschool Learning Foundations.

Visit Life Lab's Standards Database

View our Common Core in the Garden Webinar

More Resources to Connect Garden-Based Learning with the New Content Standards

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Learning …

Healthy Food …

and Nature …

… through garden-based education.

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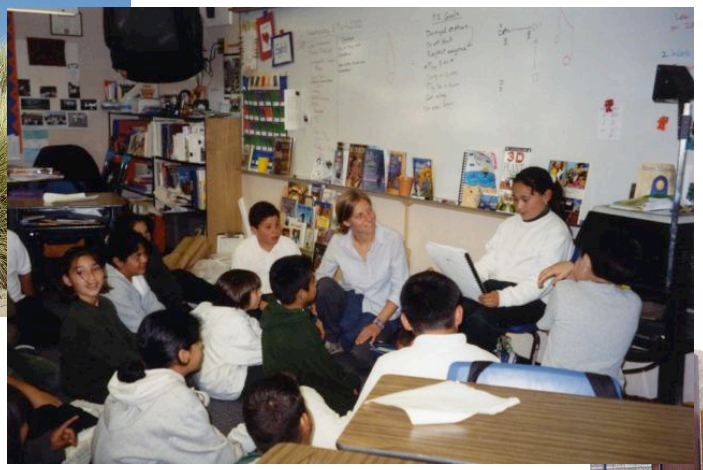


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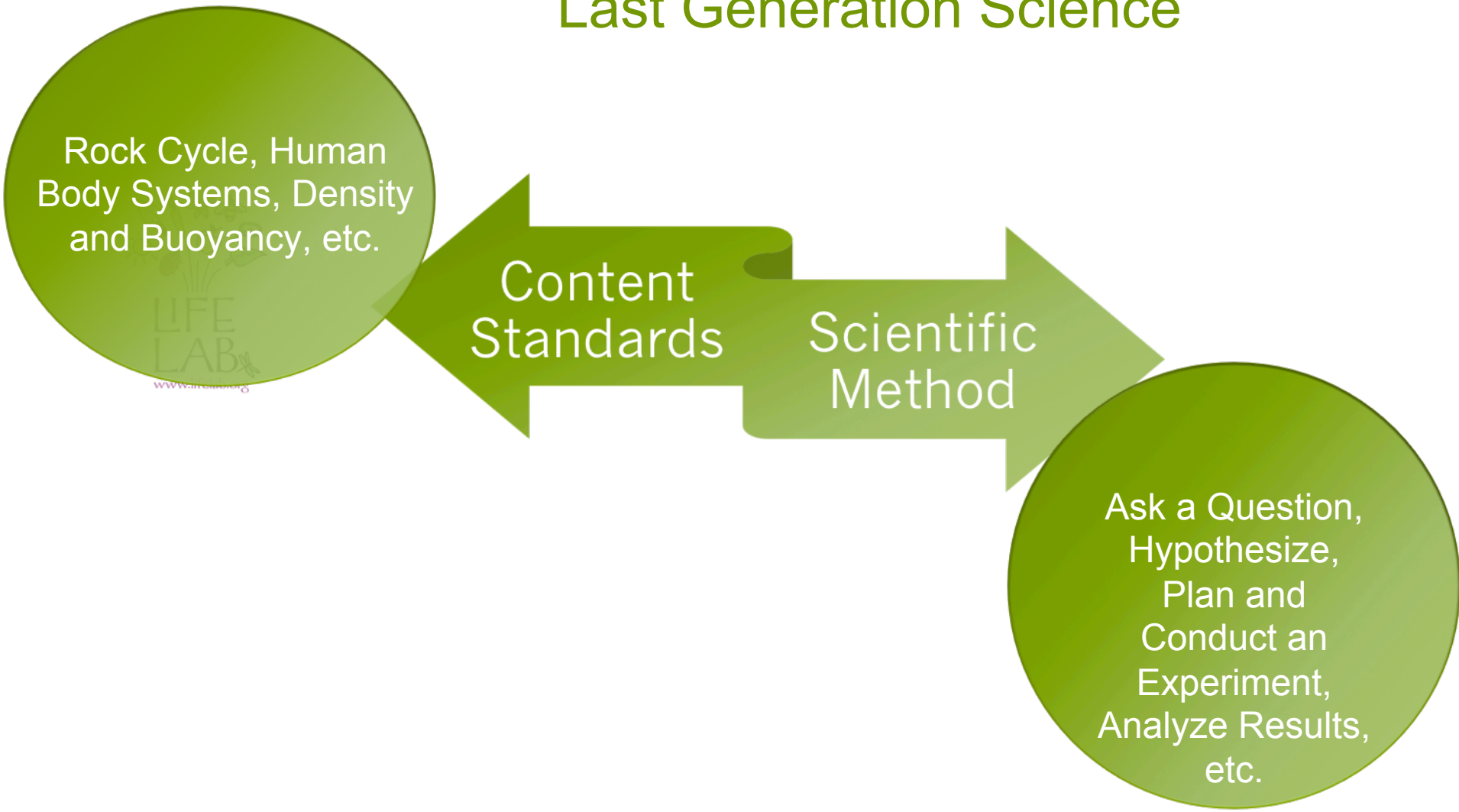
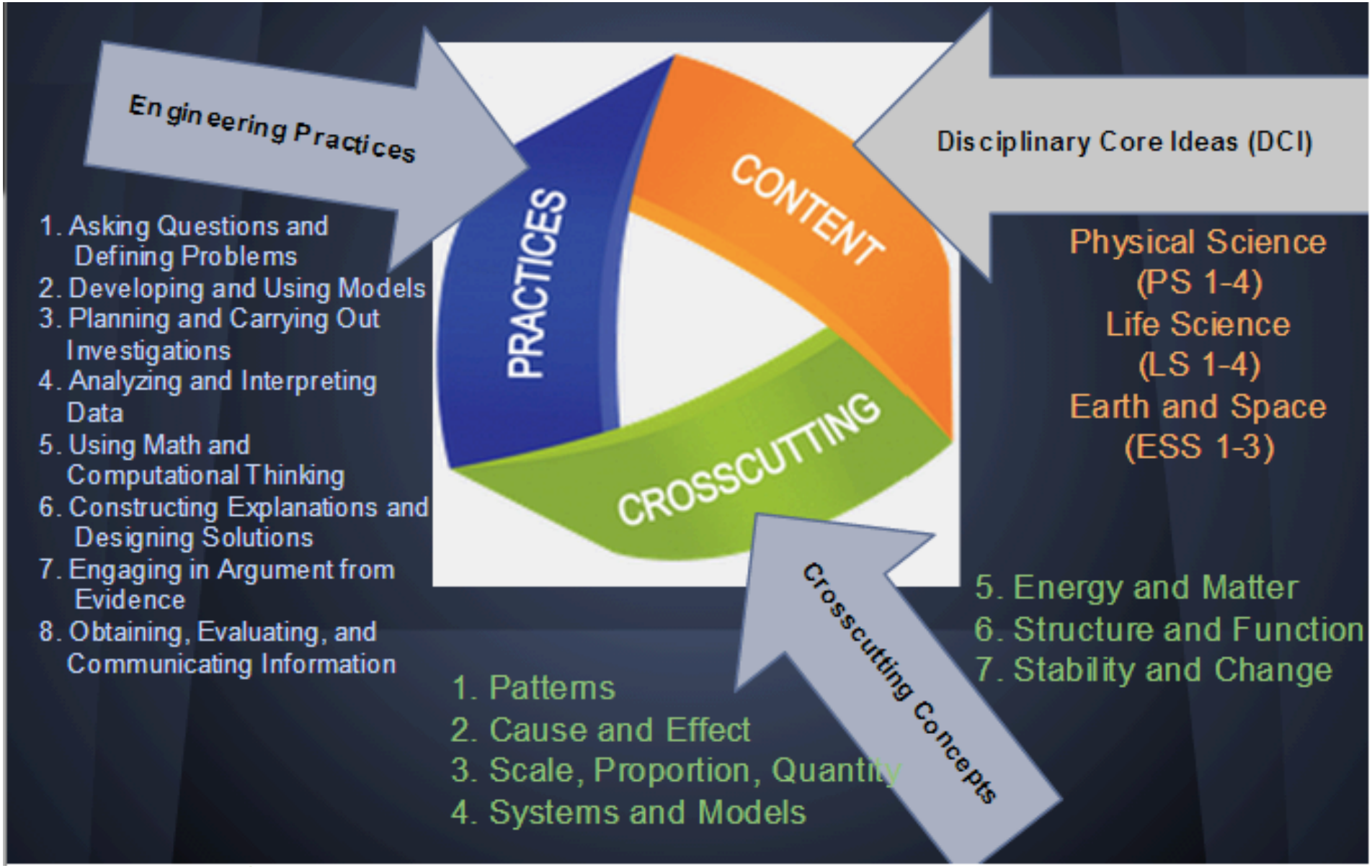
Who's With Us?

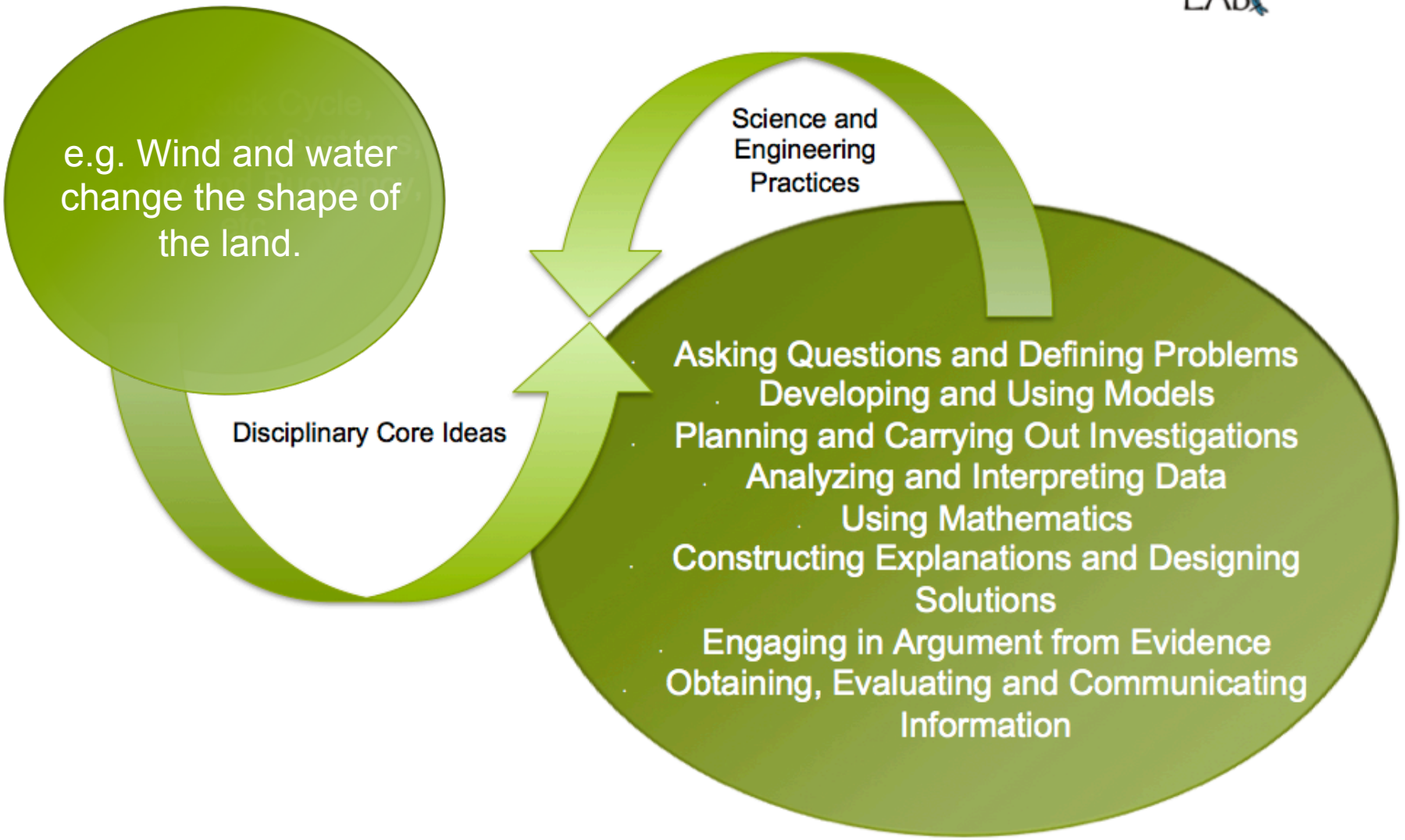
Last Generation Science



3 Dimensions of NGSS



Next Generation Science



Anatomy of the NGSS

MS-ESS1 Earth's Place in the Universe

MS-ESS1 Earth's Place in the Universe

Students who demonstrate understanding can:

MS-ESS1-1. **Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons.** [Clarification Statement: Examples of models can be physical, graphical, or conceptual.]

MS-ESS1-2. **Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.** [Clarification Statement: Emphasis for the model is on gravity as the force that holds togeth[illegible] the sola[illegible] system and Milky Way galaxy and controls orbital motions [illegible]) or [illegible] Assessment does [illegible]]

MS-ES[illegible]1-3. **A[illegible]** [Cl[illegible] Statement: Emphasis is on the analysis of data from Earth-based instruments, space-based telescopes, and spacecraft to determine similarities and differences among solar system objects. Examples of scale properties include the sizes of an object's layers (such as crust and atmosphere), surface features (such as volcanoes), and orbital radius. Examples of data include statistical information, drawings and photographs, and models.] [Assessment Boundary: Assessment does not include recalling facts about properties of the planets and other solar system bodies.]

MS-ESS1-4. **Construct a scientific e[illegible] for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.** [illegible] Emphasis is on how analyses of rock formations and the fossils they contain are used to establis[illegible] major events could range from being very recent (such as the last Ice Age or the earliest fossils of homo sapiens) [illegible] very old (such as the formation of Earth or the earliest evidence of life). Examples can include the formation of mountain chains and ocean basins, the evolution or extinction of particular living organisms, or significant volcanic eruptions.] [Assessment Boundary: Assessment does not include recalling the names of specific periods or epochs and events within them.]

Performance expectations are comprised of

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices

Developing and Using Models
Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.
- Develop and use a model to describe phenomena. (MS-ESS1-1),(MS-ESS1-2)

Analyzing and Interpreting Data
Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.
- Analyze and interpret data to determine similarities and differences in findings. (MS-ESS1-3)

Constructing Explanations and Designing Solutions
Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.
- Construct a scientific explanation based on valid and reliable evidence obtained from sources (in[illegible] the students' o[illegible] experiments) and the [illegible] the past and will [illegible] (MS-ESS1-4)

Practices

Disciplinary Core Ideas

ESS1.A: The Universe and Its Stars
- Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models. (MS-ESS1-1)
- Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe. (MS-ESS1-2)

ESS1.B: Earth and the Solar System
- The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them. (MS-ESS1-2),(MS-ESS1-3)
- This model of the solar system can explain eclipses of the sun and the moon. Earth's spin axis is fixed in direction over the short-term but tilted relative to its orbit around the sun. The seasons are a result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year. (MS-ESS1-1)
- The solar system appears to have formed from a disk of dust and gas, drawn together by gravity. (MS-ESS1-2)

ESS1.C: The History of Planet Earth
- The geologic time scale interpreted from rock strata provides a way to organize Earth's history. Analyses of rock strata and the fossil record provide only relative dates, not an absolute scale. (MS-ESS1-4)

Disciplinary Core Ideas

Crosscutting Concepts

Patterns
- Patterns can be used to identify cause-and-effect relationships. (MS-ESS1-1)

Scale, Proportion, and Quantity
- Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (MS-ESS1-3),(MS-ESS1-4)

Systems and System Models
- Models can be used to represent systems and their interactions. (MS-ESS1-2)

Connections to Engineering, Technology, and Applications of Science

Interdependence of Science, Engineering, and Technology
- Engineering advances have led to important discoveries in virtually every field of science and scientific discoveries have led to the development of entire industries and engineered systems. (MS-ESS1-3)

Connections to Nature of Science

Scienti[illegible] Knowledge Assumes an Order and C[illegible]
- Sci[illegible] in natural systems [illegible] patterns that are understandable through measurement and observation. (MS-ESS1-1),(MS-ESS1-2)

Crosscutting Concepts

Connections to other DCIs in this grade-band: **MS.PS2.A** (MS-ESS1-1),(MS-ESS1-2); **MS.PS2.B** (MS-ESS1-1),(MS-ESS1-2); **MS.LS4.A** (MS-ESS1-4); **MS.LS4.C** (MS-ESS1-4); **MS.ESS2.A** (MS-ESS1-3)

Articulation of DCIs across grade-bands: **3.PS2.A** (MS-ESS1-1),(MS-ESS1-2); **3.LS4.A** (MS-ESS1-4); **3.LS4.C** (MS-ESS1-4); **4.ESS1.C** (MS-ESS1-4); **5.PS2.B** (MS-ESS1-1),(MS-ESS1-2); **5.ESS1.A** (MS-ESS1-2); **5.ESS1.B** (MS-ESS1-1),(MS-ESS1-2),(5-ESS1-3); **HS.PS1.C** (MS-ESS1-4); **HS.PS2.A** (MS-ESS1-1),(MS-ESS1-2); **HS.PS2.B** (MS-ESS1-1),(MS-ESS1-2); **HS.LS4.A** (MS-ESS1-4); **HS.LS4.C** (MS-ESS1-4); **HS.ESS1.A** (MS-ESS1-2); **HS.ESS1.B** (MS-ESS1-1),(MS-ESS1-2),(MS-ESS1-3); **HS.ESS1.C** (MS-ESS1-4); **HS.ESS2.A** (MS-ESS1-3),(MS-ESS1-4)

Common Core State Standards Connections:

ELA/Literacy –

RST.6-8.1	Cite specific textual evidence to support analysis of science and technical texts. (MS-ESS1-3),(MS-ESS1-4)
RST.6-8.7	Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-ESS1-3)
WHST.6-8.2	Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (MS-ESS1-4)
SL.8.5	Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. *(MS-ESS1-1),(MS-ESS1-2)*

Mathematics –

MP.2	Reason abstractly and quantitatively. (MS-ESS1-3)
MP.4	Model with mathematics. *(MS-ESS1-1),(MS-ESS1-2)*
6.RP.A.1	Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. *(MS-ESS1-1),(MS-ESS1-2)*,(MS-ESS1-3)

* The performance expectations marked with an asterisk integrate traditional science content with engineering through a Practice or Disciplinary Core Idea.
The section entitled "Disciplinary Core Ideas" is reproduced verbatim from A Framework for K-12 Science Education: Practices, Cross-Cutting Concepts, and Core Ideas. Integrated and reprinted with permission from the National Academy of Sciences.

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The Next Generation Science Standards

Printer-friendly version

The Next Generation Science Standards are now available. Twenty-six states and their broad-based teams worked together with a 41-member writing team and partners throughout the country to develop the standards.

- NGSS Front Matter
- NGSS Structure
- NGSS Appendices:
  - A. Conceptual Shifts
  - B. Responses to Public Drafts
  - C. College and Career Readiness
  - D. All Standards, All Students / Case Studies
  - E. Disciplinary Core Idea

There are three ways to view the standards:

View the NGSS in Disciplinary Core Idea (DCI) Arrangements

View the NGSS in Topic Arrangements

View and Search the NGSS performance expectations individually

The NGSS are composed of the three dimensions from the NRC Framework. Click on the links to the left and see the videos below to learn more about the standards.

So what does all of this have to do with school gardens?

We See a Lot of Hands-On Learning, and Active Science in Physical Science …

But What About in Earth and Life Science?

DCI's Well-Suited to Being Taught in the Garden


SANTA CRUZ

The Garden is a “Living Laboratory” Where Students Apply Science and Engineering Practices to Deepen Their Understanding of Earth and Life Science

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Why Teach This Way?

- It's engaging, and it's how people learn!

Then why is this what it looks like in the classroom?

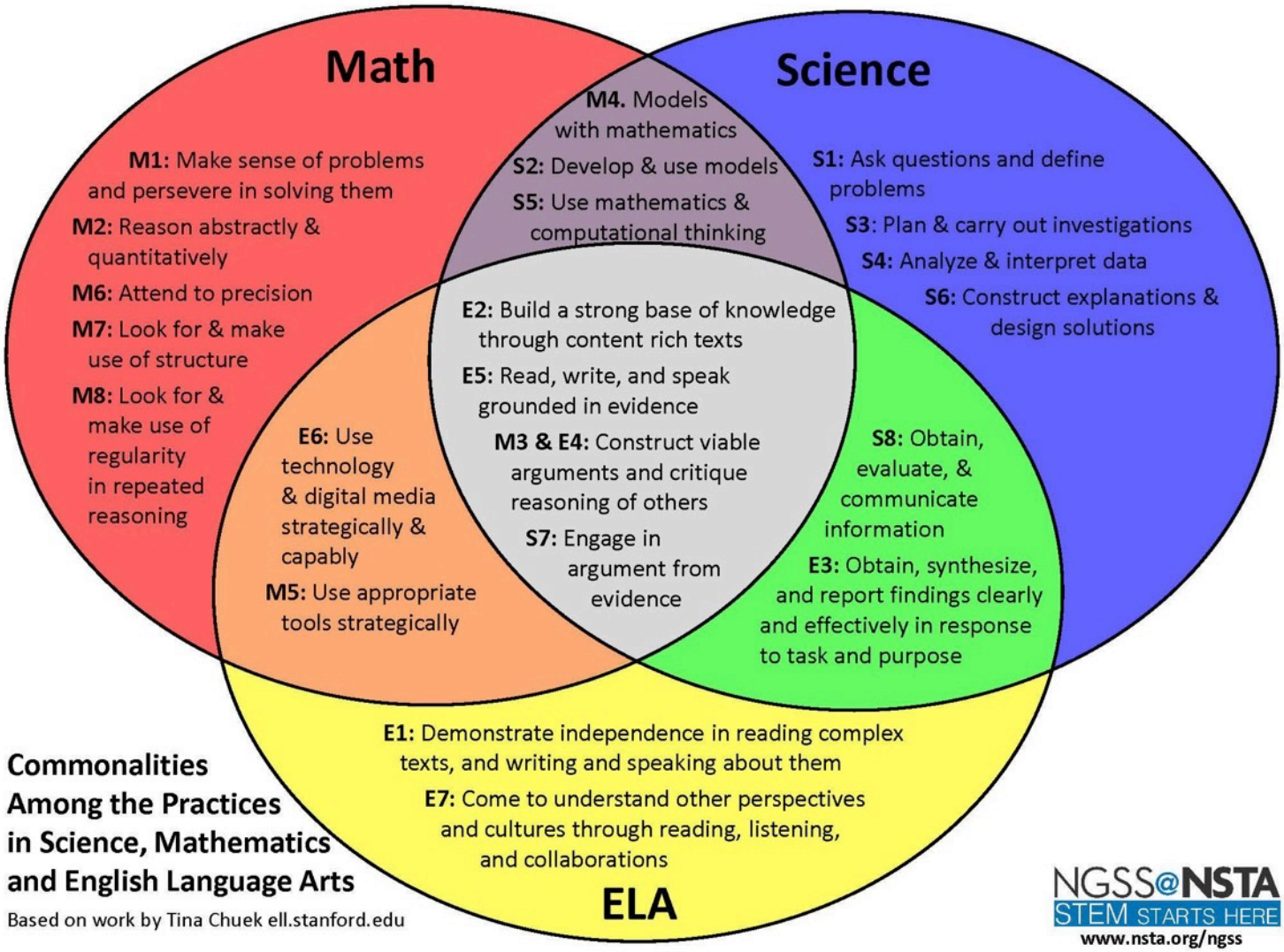
Engaging in Scientific Practices helps students develop essential skills for succeeding in the 21st Century.

- Creativity
- Critical Thinking
- Communication
- Collaboration

These “4 C’s” were identified by the Partnership for 21st Century Skills, a group of business and education leaders

But what about everything else I have to teach?!

Real-World Problems and Real-Life Connections


Math
Science
ELA
M1: Make sense of problems and persevere in solving them
M2: Reason abstractly & quantitatively
M6: Attend to precision
M7: Look for & make use of structure
M8: Look for & make use of regularity in repeated reasoning
M4. Models with mathematics
S2: Develop & use models
S5: Use mathematics & computational thinking
S1: Ask questions and define problems
S3: Plan & carry out investigations
S4: Analyze & interpret data
S6: Construct explanations & design solutions
E2: Build a strong base of knowledge through content rich texts
E5: Read, write, and speak grounded in evidence
M3 & E4: Construct viable arguments and critique reasoning of others
S7: Engage in argument from evidence
E6: Use technology & digital media strategically & capably
M5: Use appropriate tools strategically
S8: Obtain, evaluate, & communicate information
E3: Obtain, synthesize, and report findings clearly and effectively in response to task and purpose
E1: Demonstrate independence in reading complex texts, and writing and speaking about them
E7: Come to understand other perspectives and cultures through reading, listening, and collaborations
Commonalities Among the Practices in Science, Mathematics and English Language Arts
Based on work by Tina Chuek ell.stanford.edu
NGSS@NSTA
STEM STARTS HERE
www.nsta.org/ngss

The Growing Classroom Standards Database

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Common Core in the Garden | The Growing Classroom Standards Database

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Six of One, Half Dozen of the Other

Page: 66

Lesson Conditions: Indoor, Outdoor, Activity, Project, Fall, Winter, Spring

Lesson Name: Six of One, Half Dozen of the Other

Product: The Growing Classroom

Lesson Description: Groups of students use multiple senses to find and classify contrasting objects in the natural environment.

Navigation

Flip through Lesson Search Results

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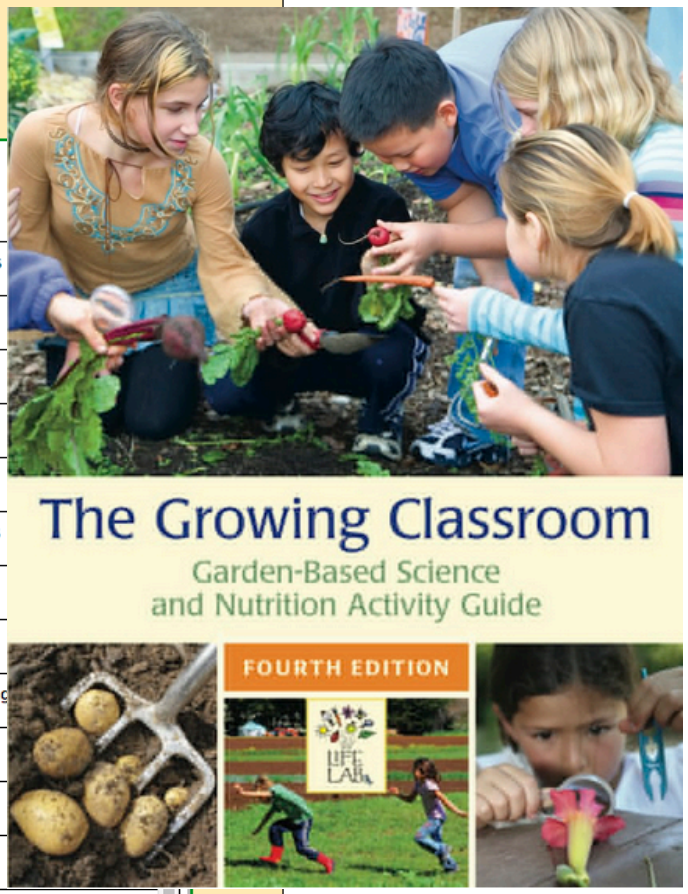
Relevant Standards

Type	Code	Standard Description	
Science	2.PS1.1	Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties	
Science	5.PS1.3	Make observations and measurements to identify materials based on their properties	
ELA	1.L.5	With guidance and support from adults, demonstrate understanding of word relationships and nuances in word meanings.	
ELA	1.L.5.a	Sort words into categories (e.g., colors, clothing) to gain a sense of the concepts the categories represent.	
ELA	1.L.5.c	Identify real-life connections between words and their use (e.g., note places at home that are cozy).	
ELA	1.SL.1	Participate in collaborative conversations with diverse partners about grade 1 topics and texts with peers and adults small and larger groups.	
ELA	2.L.5	Demonstrate understanding of word relationships and nuances in word meanings.	
ELA	2.L.5.a	Identify real-life connections between words and their use (e.g., describe foods that are spicy or juicy).	
ELA	2.L.5.b	Distinguish shades of meaning among closely related verbs (e.g., toss, throw, hurl) and closely related adjectives (e.g thin, slender, skinny, scrawny).	
ELA	2.L.5.d	Distinguish shades of meaning among verbs differing in manner (e.g., look, peek, glance, stare, glare, scowl) and adjectives differing in intensity (e.g., large, gigantic) by defining or choosing them or by acting out the meanings.	
ELA	4.SL.1	Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher- led) with diverse partners on grade 4 topics and texts, building on others' ideas and expressing their own clearly.	
ELA	4.SL.1	Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher- led) with diverse partners on grade 4 topics and texts, building on others' ideas and expressing their own clearly.	
ELA	5.SL.1	Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher- led) with diverse partners on grade 5 topics and texts, building on others' ideas and expressing their own clearly.	View Standard Detail
ELA	K.L.5.a	Sort common objects into categories (e.g., shapes, foods) to gain a sense of the concepts the categories represent.	View Standard Detail
ELA	K.L.5.b	Demonstrate understanding of frequently occurring verbs and adjectives by relating them to their opposites (antonyms).	View Standard Detail



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Life Lab Standards Database

Standard Search Results

Standard 4.LS1.1 **Standard** Science

Standard Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction

Navigation

Flip through Standards Search Results

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Print

Relevant Lessons

Lesson Title	Product	Edition	Page (3rd Ed.	Lesson Description	
The Matchmaker	The Growing Classroom	4th Edition 3rd Edition	105 (100)	In Part One of this activity, students test soil for nitrogen and plant nitrogen-fixing cover crops. Ten weeks later in Part Two, students examine nitrogen-fixing nodules on the roots of legume cover crop. After the cover crop is cut and its roots have decomposed in the soil, students retest the soil for nitrogen content.	view lesson detail
Seedy Character	The Growing Classroom	4th Edition 3rd Edition	122 (118)	In Part One, students examine and classify different types of seeds. In Part Two, students dissect soaked pinto beans.	view lesson detail
Let's Get to the Root of This	The Growing Classroom	4th Edition 3rd Edition	124 (120)	Students will observe root growth in a root view box.	view lesson detail
Adapt-a-Seed	The Growing Classroom	4th Edition 3rd Edition	130 (124)	Students will use human-made materials to adapt seeds for dispersal such as flying and floating.	view lesson detail
Seed Power	The Growing Classroom	4th Edition 3rd Edition	131 (125)	Students fill a jar with seeds, add water, and observe what happens. Start this activity first thing in the morning.	view lesson detail
Lotus Seeds	The Growing Classroom	4th Edition 3rd Edition	134 (128)	Students hear a true story about the tenacity of seeds.	view lesson detail

K-8 Next Generation Science Standards in the Garden

A list of NGSS that are well suited for Garden-Based Learning

Science and Engineering Practices (All 8)

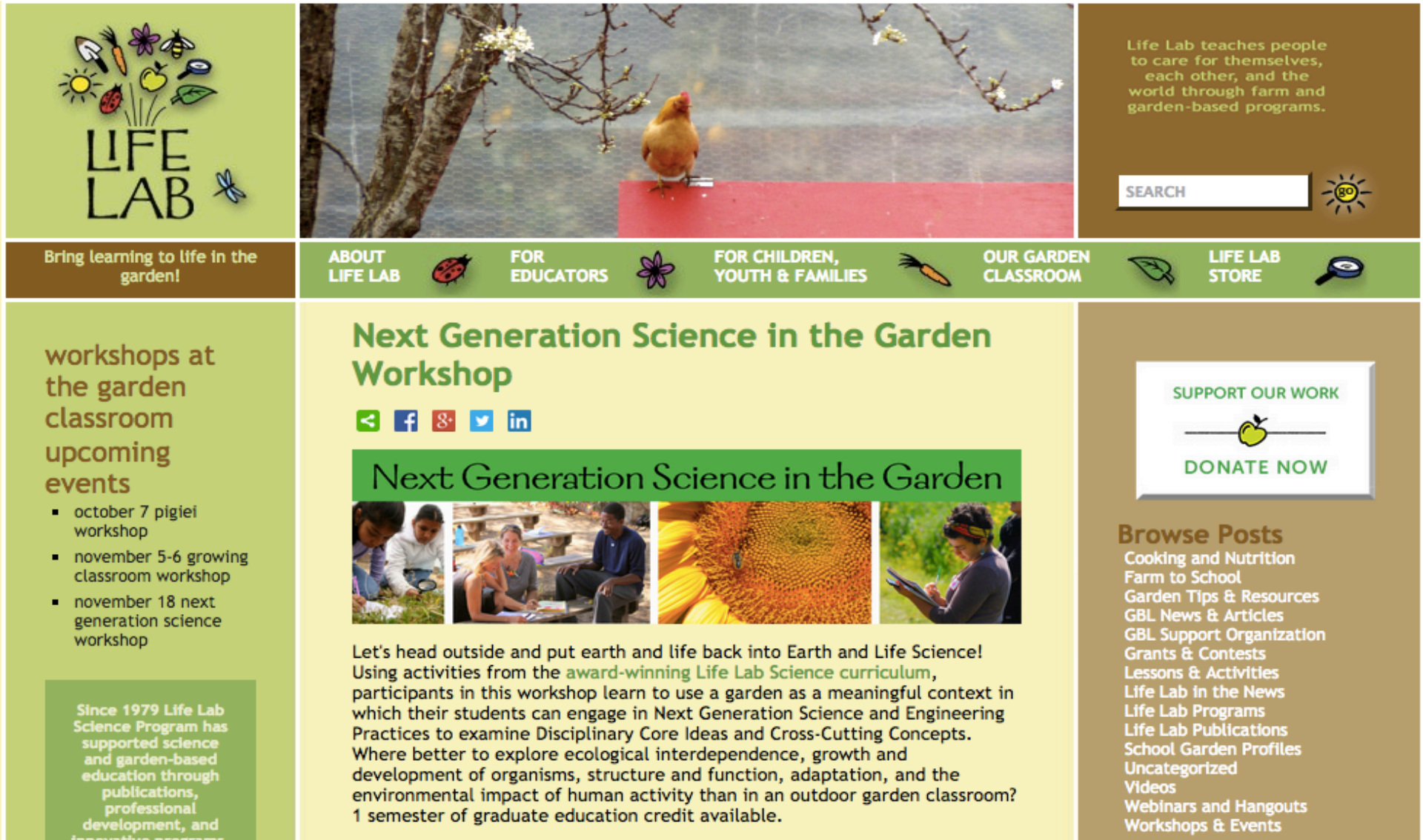
- Asking questions and defining problems
- Developing and using models
- Planning and carrying out investigations
- Analyzing and interpreting data
- Using mathematics and computational thinking
- Constructing explanations and designing solutions
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information

Performance Expectations

Key to codes:
Grade - LS (Life Sciences), ESS (Earth and Space Sciences), PS (Physical Sciences) – Standard Number

K-LS1-1	Use observations to describe patterns of what plants and animals (including humans) need to survive
K-ESS2-1	Use and share observations of local weather conditions to describe patterns over time
K-ESS2-2	Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs
K-ESS3-1	Use a model to represent the relationship between the needs of different plants of animals (including humans) and the places they live
K-ESS3-3	Communicate solutions that will reduce the impact of humans on the land, water, air, and/or other living things in the local environment

November 18, 2015 – Hands-On Workshop in Santa Cruz, CA … or Bring Us to Your Site!



A Simple Way to Start

- Starting with your existing activities or lessons, look for opportunities for students to engage in the 8 Practices:
  - Asking Questions and Defining Problems
  - Developing and Using Models
  - Planning and Carrying Out Investigations
  - Analyzing and Interpreting Data
  - Using Mathematics and Computational Thinking
  - Constructing Explanations and Designing Solutions
  - Engaging in Argument from Evidence
  - Obtaining, Evaluating and Communicating Information

Create Instructional Habits that Relate to these Practices

- Example: Constructing Explanations and Arguing from Evidence

"List as many possible explanations as you can for this phenomenon."

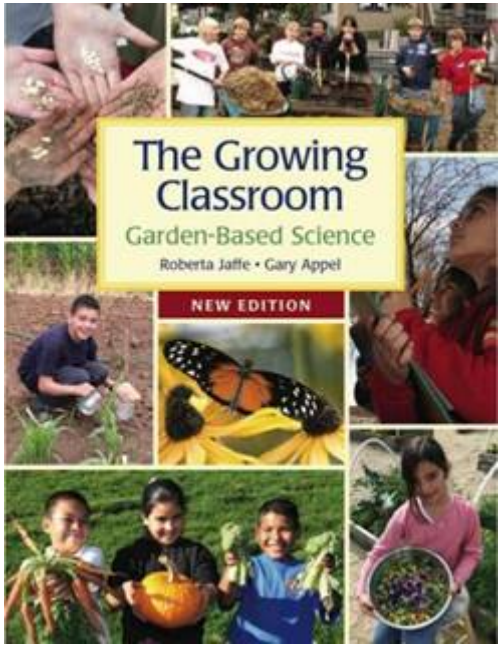
"Now look at that list and prepare to share which explanation you think is likely based on the evidence.*"

*Evidence could be physical evidence in the garden, or evidence they have gathered from information texts or other sources.

- "Let's brainstorm possible solutions. Again, which is the most likely to work based on the evidence?"

Even Simpler …

- “What questions do you have about this phenomenon?”



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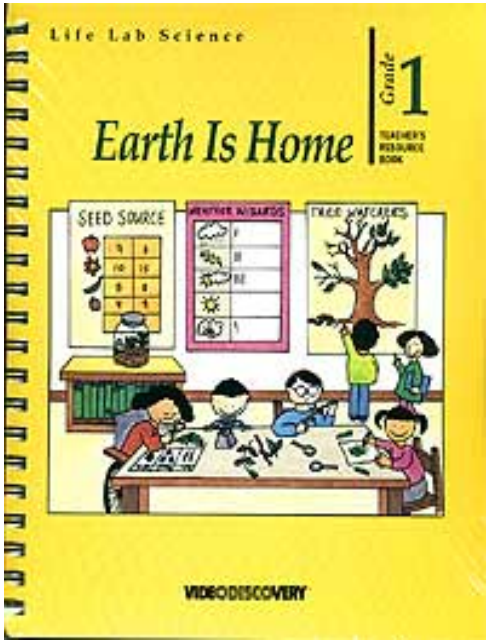
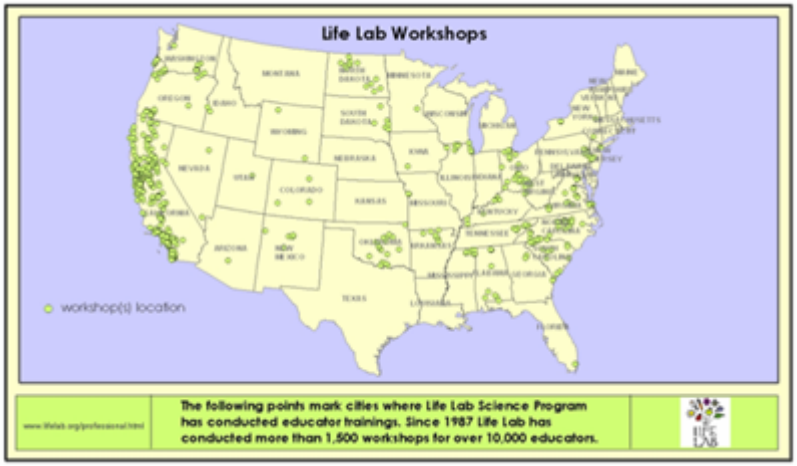


K - 5 Life Lab Science
Curriculum

Materials to Support
Garden-Based
Learning



Even if you live far away, we have loads of resources for you!

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Questions?

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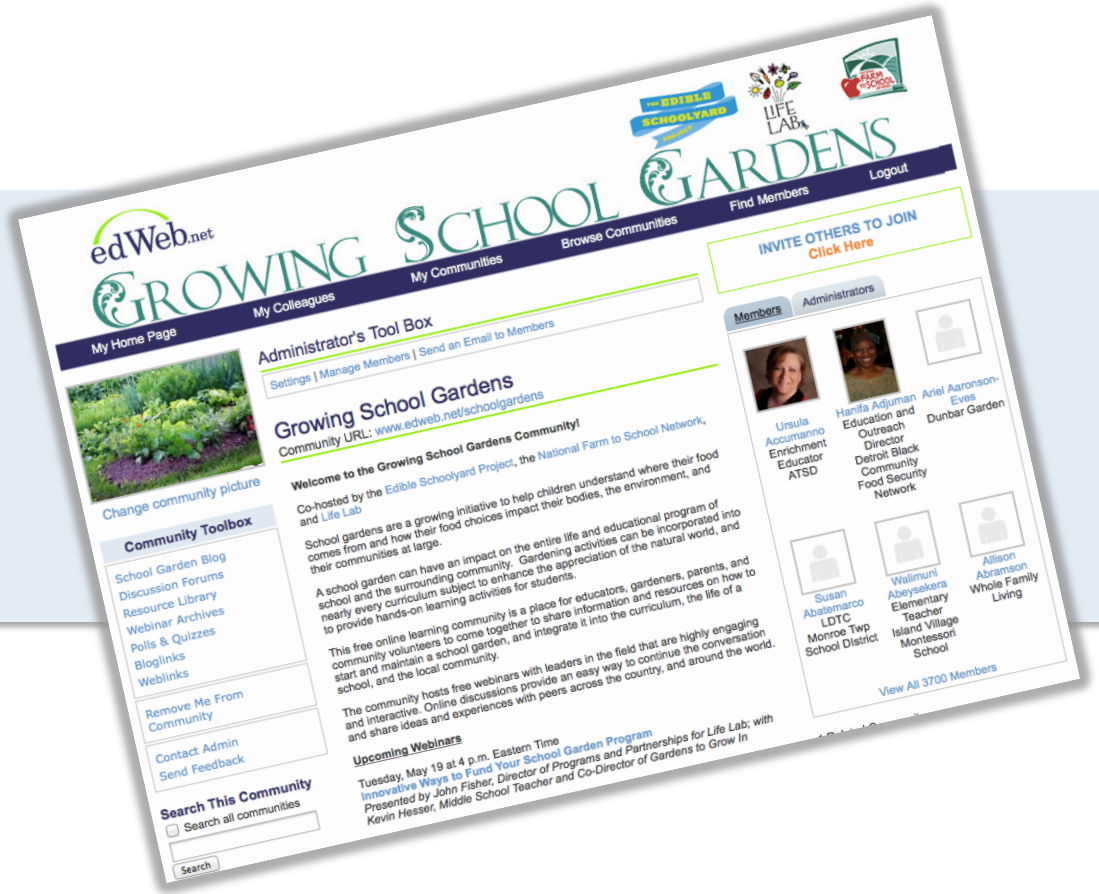

- ✓ Invitations to upcoming webinars
- ✓ Webinar recordings and resources
- ✓ CE quizzes
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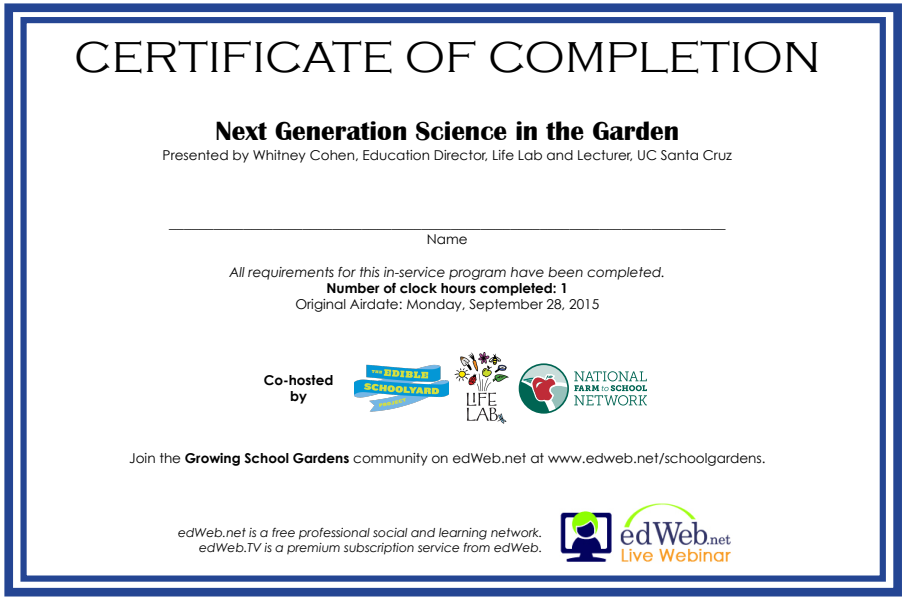
Recognition for your participation today!



CERTIFICATE OF COMPLETION

Next Generation Science in the Garden

Presented by Whitney Cohen, Education Director, Life Lab and Lecturer, UC Santa Cruz

_____

Name

All requirements for this in-service program have been completed.
Number of clock hours completed: 1
Original Airdate: Monday, September 28, 2015

Co-hosted by

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