Next Generation Science Standards in Connecticut

CAS Webinar
November 17, 2015

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A set of learner outcomes designed to engage ALL students in “practicing” science the way real scientists do, and applying their knowledge to explain things in the real world.
Why Update CT Science Education?

- Next step for CT’s 11-year old science standards
- Recent research on how students best learn science
- Captivate diverse students; close gaps
- Consistent with CT Core Standards and College Board AP emphasis on thinking, reasoning and communication skills needed for life, college and workforce
- Bring clarity to “STEM” education
Advances in HOW Science is Learned

Students’ Discussing & Critiquing Ideas

Science Applied to Engineering Design

Students Reasoning with Evidence

Curriculum that Builds Knowledge in Real-World Contexts

Applying Science to Explain Real-World Phenomena

Coherent Learning Progression Focused on BIG ideas

Students Integrating 3 Dimensions to Construct (not repeat) Explanations & Design Solutions
What to Look For in a Next Generation Science Classroom

- Asking questions and defining problems
- Developing and using explanatory models
- Planning and carrying out investigations
- Analyzing and interpreting data

Students Using Science & Engineering Practices to Construct Understanding

- Using mathematics and computational thinking
- Developing explanations and designing solutions
- Using data/evidence to support a conclusion
- Obtaining, evaluating, and communicating information
### 3-Dimensional Teaching and Learning: What Counts as Evidence of Science Understanding?

<table>
<thead>
<tr>
<th>Current Connecticut Standards</th>
<th>Next Generation Standards</th>
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<tr>
<td><strong>Describe</strong> the effects of the strengths of pushes and pulls on the motion of objects.</td>
<td><strong>Plan and conduct</strong> an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.</td>
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<td><strong>Describe</strong> the basic structures of an animal cell, including the nucleus, cytoplasm, mitochondria and cell membrane, and how they function to support life.</td>
<td><strong>Develop and use a model</strong> to describe the function of a cell as a whole and ways parts of cells contribute to the function.</td>
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<td><strong>Use mathematical operations to analyze and interpret data, and present relationships between variables in appropriate forms.</strong></td>
<td><strong>Use mathematical representations to support explanations of how</strong> natural selection <strong>may lead to</strong> increases and decreases of specific traits in populations over time.</td>
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Design a School Butterfly Garden:
Conduct tests for soil nutrients and water retention. Record hours of sunlight and average wind speed. Measure and mark a square foot grid to calculate the perimeter and area of the garden. Research butterfly life cycle and plant needs. Present information. Select plants adapted for site conditions...
Integrating Science, Math, ELA & Engineering to Solve Real-World Challenges

*Design, Construct and Model a Working Bridge:* Applying an understanding of forces to the working structure of bridges. Using Engineering practices to test structural strength and expose design weaknesses.

[Image of students working on a bridge model]

*Learning by doing*
NGSS 4-LS1-1: Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior and reproduction.

CCS-ELA W4.1: Write opinion pieces on topics or texts, supporting a point of view with reasons and information.

CCS-M 4.G.A.3: Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded across the line into matching parts. Identify line-symmetric figures and draw lines of symmetry.
10

5-LS1-1. Support an argument that plants get the materials they need for growth chiefly from air and water. [Clarification Statement: Emphasis is on the idea that plant matter comes mostly from air and water, not from the soil.]

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**
- Engaging in Argument from Evidence
- Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s).
- Support an argument with evidence, data, or a model. (5-LS1-1)

**Disciplinary Core Ideas**
  - Plants acquire their material for growth chiefly from air and water. (5-LS1-1)

**Crosscutting Concepts**
- Energy and Matter
  - Matter is transported into, out of, and within systems. (5-LS1-1)

*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.
What to Listen For in a Next Generation Science Classroom

- Students talk to each other; not just answer teacher questions
- Build on and challenge each others’ explanations
- Develop language skills, social skills and team mindset

Fourth Graders Discussing
What Makes the Water Level Rise: Weight or Volume?
Questions About the NGSS Vision?
Time and Support for Systemic Change
Supporting Systemic Change to Next Generation Science Over Time

On-going Professional Learning

Curriculum Adaptations
- Redesigning Existing Learning Units
- Accessing Available Learning Units

Instructional Adaptations
- 3-Dimensional Teaching & Learning

Assessment Adaptations
- 3-Dimensional Performance Expectations
5-Year Implementation Timeline

2014-15
AWARENESS
NGSS PD for pre-service faculty & district science leaders
Develop new system of NGSS professional learning

2015-16
CAPACITY-BUILDING
Recruit and train expert PD facilitator cohort
Launch new system of professional learning
State Board of Education NGSS Adoption

2016-17
PROFESSIONAL DEVELOPMENT
District curriculum upgrades begin
NGSS Local Assessment Resources developed

2017-18
IMPLEMENTATION in Gr. 3, 6, 9
On-going PD
District curriculum upgrades continue
NGSS Local Assessment Resources Available (voluntary)

2018-19
IMPLEMENTATION in Gr. 4, 7, 10
On-going PD
District curriculum upgrades continue
NGSS Local Assessment Resources Available (voluntary)

2019-20
IMPLEMENTATION in Gr. 5, 8, 11
On-going PD
NGSS Local Assessment Resources Available (voluntary)

* Subject to change pending changes to federal law and state policies

CONNECTICUT STATE DEPARTMENT OF EDUCATION
Building a New System of Science Assessments*

- Local Assessment Resources (voluntary)
- State-Administered Summative Assessment
- Indicators of Students’ Opportunities to Learn Next Generation Science

* Not approved by the State Board of Education or the CT General Assembly; subject to change.
Contrast Traditional and NGSS Assessment Questions

Source: Developing Assessments for the Next Generation Science Standards (Pellegrino, et al)

http://tinyurl.com/qxsms89

**Traditional**

The major movement of the plates and description of plate boundaries of the Earth are...

A. Convergent  
B. Divergent  
C. Transform  
D. All of the Above

**NGSS-style**

A. Draw on the picture to show what is happening in the mantle that causes the plates to move apart.

B. What is happening in the mantle that helps to explain why the two plates are moving apart?

C. Put an X on the places in the picture above where the oldest rock can be found in the crust.

D. Explain your answer.
Sample NGSS Assessment Task to Elicit Evidence of Understanding
Source: http://ngss-assessment.portal.concord.org/

Performance Expectation MS-PS1-1: Develop models to describe the atomic composition of simple molecules and extended structures.

Oxygen gas and ozone gas are different substances. The molecules of both gases are made up of only oxygen atoms. Below are three different models drawn by students.

**Question #1**
Based on what you know about substances, which model above best shows that oxygen gas and ozone gas are different substances? Explain why you chose this model.

**Question #2**
Explain why the other models do not work.
Type answer here
System of Professional Learning

CSDE-Trained Professional Learning Facilitators

- **Intro to Framework & NGSS**
  - On-line Modular Short Course
  - Launch November 2015
  - NGS-CT District-led Study Groups

- **Next Gen Science Pedagogy**
  - On-line Modular Short Course
  - Launch January 2016
  - NGSX Expert-Led Regional Study Groups

- **Next Gen Science Inquiry**
  - In-Person Institute
  - Launched Summer 2015
  - CT Science Center

- **Curriculum Design Institutes**
  - In-Person Content-Specific Institutes
  - Launch 2016
  - CT Science Center

- **Performance Task Workshops**
  - Launch 2016

- **Learning Unit Workshops**
  - Launch 2016
Connecticut Science Educators Professional Development Day

Date: Saturday, November 21, 2015
Hamden Middle School, Hamden, CT.

Time: 8:00 AM - 4:00 PM

The 2015 Connecticut Science Educators’ Professional Development Day will be held on Saturday November 21 at Hamden Middle School, Hamden, CT. This annual event attracts hundreds of science educators from across the state and throughout New England for workshops, seminars, speakers and commercial exhibitors.

Come for our Special NGSS track—renowned and national presenters and speakers, all to help you get ready for great science teaching. With a decision on Next Generation Science expected from the CT State Board of Education this fall, science is on everyone's minds!

<table>
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<tr>
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<tbody>
<tr>
<td>Session A</td>
<td>A1 NGSS @ NSTA Hub with Ted Willard</td>
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<tr>
<td>Session A</td>
<td>A2 NGSSX: the Next Generation Science Exemplar System</td>
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<td>Key Note Speaker</td>
<td>Dr. Mary Gromko, NSTA President-elect 2015-2016</td>
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<td>Session B (Special Long Session)</td>
<td>B2 EQuiP: What does three-dimensional learning look like? Special 1.5 hr. session</td>
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<tr>
<td>Session C (Special Long Session)</td>
<td>C1 EQuiP: What does three-dimensional learning look like? Special 1.5 hr. session</td>
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<tr>
<td>Session D</td>
<td>D1 Next-Gen Science CT: An Online Short Course for NGSS</td>
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</tbody>
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• Broad introduction; no prior NGSS knowledge required
• Designed with and for CT educators
• No-cost
• Designed for PLCs; works best with an effective facilitator of discussion; or
• Join an on-line discussion
• Modules 1-3 available now; 4-15 to be released over the coming months
• Can earn emailed certificate & badge
• Learn about Next Gen Science directly from authors of the standards and with CT’s certified learning facilitators

• Focus on modeling, argument with evidence and scientific explanation of real world phenomena

• Registration opens Nov. 19 for winter, spring and summer sessions (15 options) in all parts of the state

• To get a sense of the NGSX learning experience, go to: http://www.ngsx.org/index.php/public/home
Supports for Teachers

- Sample Learning Units
  - Coming Spring 2016
- Classroom Assessment Resources
  - Coming 2017
- NSTA NGSS Hub
- Sample Performance Tasks
Questions and Discussion
Getting Involved and Staying Informed

• CSDE Science mailing list – Elizabeth.buttner@ct.gov
• District Advisory Council – contact Liz Buttner
• State Science Assessments – contact Jeff Greig at jeff.Greig@ct.gov
• Science Performance Tasks – contact Ron Michaels at Ronald.Michaels@ct.gov