#### Curriculum Committee

Thursday, May 28, 2015 4:30 PM Curriculum Committee, L.P. Wilson Community Center, Room 17, 601 Matianuck Avenue, Windsor, CT 06095

- 1. Call to Order, Pledge to the Flag and Moment of Silence
  - 2. Audience to Visitors
- 3. Music Fundamentals
  - 4. Economics
- 5. Grade 7 Health
  - 6. NGSS Update and Survey
- 7. Adjournment





#### CONNECTICUT STATE DEPARTMENT OF EDUCATION

### An Invitation to Consider Next Generation Science

#### In Connecticut



Date: May 28, 2015 Presented to: Windsor Public Schools Board of Education Curriculum Subcommittee Presented by: Christine Tedisky

#### Foreword

The information regarding curriculum and assessment transition timelines described in this presentation has not yet been detailed or formally accepted, either by the State Board of Education or the Connecticut General Assembly. In an effort to be transparent and inclusive in its NGSS pre-adoption processes, preliminary information about transitioning to new state assessments has been included and is subject to change.



#### Next Generation Science in Connecticut CSDE Pre-Adoption Stakeholder Communication Plan

	April (Group A)			July
2015	Superintendents and Asst. Supts. Commissioner letter Acad Office Newsletters RESC Curriculum Councils	<ul> <li>Superintendents and Asst.</li> <li>Supts.</li> <li>Presentations and feedback survey facilitated by district science leaders</li> </ul>		
	Union leaders <ul> <li>TBD</li> </ul>	<ul> <li>Local school boards</li> <li>CABE webinar (May 21)</li> <li>Presentations and feedback survey facilitated by district science leaders</li> </ul>		
	Legislature • TBD	<ul> <li>Principals</li> <li>Presentations and feedback survey facilitated by district science leaders</li> </ul>	CAS webinars (May 26, 27)	$\Rightarrow \Rightarrow$
		<ul><li>Families</li><li>CT PTA Focus Group (Westport Town Hall, May 19)</li></ul>	<ul> <li>Families</li> <li>Community and Family Engagement Network "Brunch &amp; Learn" (Mystic Aquarium, June 17)</li> </ul>	
	CSDE	<ul> <li>Education Advocacy Group</li> <li>CT Academy of Scientists and Engineers Focus</li> </ul>	cation Advocacy Groups     Special education, English     language learners (Mystic	Ready to report to SBE

#### Stakeholder Engagement and Communication

- State Board of Education has prioritized *transparency* and *inclusivity* in all standards adoption processes
- Build on 2 years of outreach to science community; now reach beyond to diverse stakeholders
- 2-way communication is at the core: info and feedback

PRE-ADOPTION SHORT-TERM GOALS:

- Raise public awareness of Next Gen Science and its implications for teaching and learning of science and STEM.
- Gain public support for upgrading to new science standards
- Extensive public outreach campaign May through July
- Report to State Board



#### A Vision for Science Education



"Students, <u>over multiple years</u> of school, <u>actively engage</u> in science <u>and</u> engineering practices and <u>apply</u> crosscutting concepts to deepen their <u>understanding</u> of each fields' disciplinary <u>core ideas</u>."

Framework Ch.1



# **Goals of Science Education**

- The *Framework's* vision expresses 2 major goals for K-12 science education:
- (1) Educating <u>all</u> students in science and engineering.
- (2) Providing the foundational knowledge for those who will become the scientists, engineers, technologists, and technicians of the future.



A Vision for Science Education in Connecticut

- Harness educator passion & knowledge to inspire & engage ALL students
- Graduate students who stay in-state pursuing careers with CT STEM companies
- Graduate informed citizens who can reason logically, think critically, and address local and global challenges.



Why Upgrade Connecticut Science Standards?

➤Next step for CT's 10-year old science standards

- >Large achievement gaps on state assessments
- ➤Bring clarity to "STEM" education
- ► Advances in science and technology
- Advances in understanding how students learn science



# Why Upgrade Connecticut Science Standards?

- Stronger alignment with CT Core Standards in Mathematics and Language Arts
- "21<sup>st</sup> Century" career-readiness skills bring engineering, problem-solving, analytical thinking and communicating to the foreground
- Science observation, argumentation and discourse develops <u>language</u> skills
- Internationally benchmarked standards keep CT students globally competitive
- AP tests have been redesigned to reflect more reasoning with evidence and less memorization



Why Upgrade Connecticut Science Standards?

- Alignment with college/career readiness standards in other disciplines
- ➤Many of today's (and future) jobs require STEM knowledge
- Many STEM jobs pay well and don't require advanced degrees
- ➤CT has lots of jobs in STEM industry that could be filled by CT students



#### COMPARISON OF NGSS AND CT STANDARDS Connections to Common Core



### Potential Benefits of Adoption of NGSS

- ► Alignment to College Board AP Science standards
- ➤ Greater equity and consistency across CT districts
- Enhanced teaching practices reflecting current research
- Collaboration across states on instructional materials, assessments and professional development
- ➤ Clarify identity of "STEM" education in CT
- Improve reading, writing, speaking and listening skills
- ►Improve mathematics practice and knowledge



## Development of Next Generation Science Standards



# Building on the Past... Reaching Toward the Future



# **Two-Step Process...One Vision**

#### **STEP 1 - FRAMEWORK FOR K-12 SCIENCE EDUCATION**

- ➤ Based on 15 years of science education research
- Written by teams of scientists (including 2 Nobel Laureates), science educators, education researchers, and state leaders
- Envisions a new approach to inspiring and preparing all students for life, college, careers and global competitiveness
- Describes 3 integrated dimensions of knowing science: Practices, Core Ideas and Crosscutting Concepts all students should know
- Provides a foundation for development of specific learner outcomes

#### **STEP 2 - NEXT GENERATION SCIENCE STANDARDS (NGSS)**



- Written by 41 accomplished science educators guided by 26 Lead States
- Based upon Framework research and recommendations
  - Adds "3-Dimensional" Student Performance Expectations
- Adds Connections to Common Core
- Adds Appendices for elaboration



### Overview of Next Generation Science Standards





# How Do NGSS Differ From Previous Science Standards?

#### MORE\_EMPHASIS

- Students *developing* explanations using evidence
- Students investigating explanations of real-world phenomena
- Students reading various informational news articles, magazines, journals and web-based resources

#### LESS EMPHASIS

- Students repeating explanations given by teacher or textbook
- Students following instructions to do experiments
- Students reading textbooks and answering questions at the end of the chapter



# Students Learn Through 3 Intertwined "Dimensions" of Science

The NGSS are written as "Performance Expectations that blend a Practice with a **Core Idea** and a Crosscutting Concept.



Engineering Integrated with Science

SAMPLE NGSS PERFORMANCE EXPECTATION WITH 3 DIMENSIONS

Analyze and interpret data to provide evidence that **plants and animals have traits** 

inherited from parents and that variation of these traits exists in a group of similar



#### Science and Engineering Practices: Central to Next Gen Science Learning

- 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



### Comparison of CT Inquiry Standards to NGSS Practices

#### **CONNECTICUT INQUIRY**

- 2 separate dimensions (inquiry, content)
- Engineering concepts appears once in grade 8
- Students conduct experiments and report findings

#### **NGSS PRACTICES**

- 3 integrated dimensions (practices, core ideas, cross cutting concepts)
- Engineering design integrated into all K-12 standards
- Students construct evidencebased explanations and apply knowledge to explain realworld phenomena



# **Core Disciplinary Ideas**



### **Crosscutting Concepts**

# Cause and Effect



#### Engineering Design Cycle: Apply Science Knowledge to Solve Real World Problems







#### Engineering Design Integrated with Science

Sample Learner Outcomes from NGSS:

KINDERGARTEN PHYSICS: Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or a pull.\*K-PS2-2.

**GRADE 3 LIFE SCIENCE:** Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.\*3-LS4-4.

**GRADE 6-8 PHYSICS:** Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.\*MS-PS3-3.

**GRADE 9-12 LIFE SCIENCE:** Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.\*HS-LS2-7.



# Measuring Success



# Assessing Next Generation Science Learning

#### Connecticut: One Dimension (at a time)

*Describe* the effects of the strengths of pushes and pulls on the motion of objects.

*Describe* the basic structures of an animal cell, including the nucleus, cytoplasm, mitochondria and cell membrane, and how they function to support life.

*Provide explanations* to investigated problems or questions.

#### NGSS: Three Dimensions (simultaneously)

*Plan and conduct an investigation to provide evidence* of the effects of balanced and unbalanced forces on the motion of an object.

**Develop and use a model** to describe the function of a cell as a whole and ways parts of cells contribute to the function.

*Use evidence to support the explanation* that traits can be influenced by the environment.



#### Sample Test Questions: Traditional and NGSS

#### **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





- 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.

#### Envisioning a New System of Assessments





Proposed Transition to Next Generation									
Science State Assessments									
	Spring 2016	Spring 2017	Spring 2018	Spring 2019					
CMT and CAPT Science (cumulative tests at Grades 5 and 8; high school)	Aligned to CTSS	Aligned to CTSS	Aligned to CTSS	First live administration of state assessment aligned with NGSS					
Next Gen Science Assessment Development	NGSS item piloting	NGSS item piloting; Report NGSS "Readiness"	NGSS item piloting; Report NGSS "Readiness"	TBD					

CTSS = Current Connecticut Science Standards (adopted in 2004) NGSS = Next Generation Science Standards (adoption under consideration)



# Making Transitions How will science teaching, learning and assessment be different?



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# Equitable Opportunities to Reason with Evidence

# A video example of sense-making discourse among diverse students:

"Is it weight or volume that makes the water level rise when you drop an object that sinks into a glass of water?"

https://www.dropbox.com/sh/72az27pbc1m9461/AAAIdorYGWjKZ71XiRHTmhExa#lh:null-TP01\_Classroom\_Discussion\_Final\_v2\_sub\_sm\_H264.mov





#### **Building Critical Thinking Through Discourse**



Example of classroom "talk starters" that support critical thinking in all subject areas by teaching students to make evidence-based arguments

Grade 2 Classroom Poster – Wallingford, CT Teacher: Lori Farkash

#### A Model for Transitioning District Curriculum and Instruction\*

CTSS = Connecticut's current state science standards (CSDE, 2004) NGSS = Next Generation Science Standards (Lead States, 2013)

Grade	2015-16	2016-17	2017-18	2018-19
PK-3	CTSS	NGSS	NGSS	NGSS
4	CTSS	CTSS	NGSS	NGSS
5	CTSS	CTSS	CTSS	NGSS
6	CTSS	NGSS	NGSS	NGSS
7	CTSS	CTSS	NGSS	NGSS
8	CTSS	CTSS	CTSS	NGSS
9	CTSS	NGSS	NGSS	NGSS
10	CTSS	CTSS	NGSS	NGSS
11-12	CTSS	CTSS	CTSS	NGSS



#### Resources Available for District-Led Study Groups



The Foundation for the NGSS: http://www.nap.edu/catalog.php? record\_id=13165



NGSS Standards, Appendices and Resources: http://www.nextgenscience.org



Webinars, Parent Information, and Teaching Resources:

http://www.nsta.org/about/standardsupdate/



# **Cost Considerations**

- 1. Investment in high quality NGSS professional learning: fees, release time and subs
- 2. Adapting and/or acquiring NGSS "3-dimensional" instructional materials
  - Limited commercially-available instructional materials at present
- 3. Adequate staffing, space & scheduling for 3 years of HS science for ALL students
- 4. Materials and supplies for elementary science teaching and learning.

Professional Learning: The Key to Success

#### Before buying NGSS teaching materials...

**Learn** about the vision of science teaching and learning described in the NRC Framework:

**Build** District Capacity through on-going professional learning to enhance science <u>teaching</u> practices.



# Transitioning to New Approaches to Teaching, Learning and Assessing Science

- 2014: Professional development for pre-service university faculty and in-service teachers and administrators
- 2015: Professional development for pre-service university faculty and in-service teachers and administrators; NGSS state pilot items
- 2015: CSDE recommendation of adoption to SBE

If NGSS is adopted by SBE in 2015, then ...

- 2016-2018: Phased-in curriculum changes begin; PD continues; state item piloting continues and "readiness" pilot tests available for district use
  - 2019: First administration of Next Gen science state assessments



# **District To Do List**

2015-2016: Invest in high quality PD offered by State

2015-2017: Enroll district teams to collaborate in curriculum development institutes beginning June 2015

2016-2018: Adapt and/or acquire NGSS instructional materials

2016-2019: Expect and "look for" transformed teaching practices critical for student success on NGSS assessments

# To Learn More About NGSS in CT

- CSDE Science Page <u>http://www.sde.ct.gov/sde/cwp/view.asp?a=2618</u> <u>&q=320890</u>
- Ellen Cohn, Interim Chief Academic Officer, <u>ellen.cohn@ct.gov</u>
- Liz Buttner, Curriculum and Instruction, <u>elizabeth.buttner@ct.gov</u>
- ≻Jeff Greig, Assessments, jeff.greig@ct.gov
- ➢Ron Michaels, Performance Tasks, ronald.michaels@ct.gov



# Stakeholder Survey

https://www.surveymonkey.com/s/PreadoptionNGSS



#### Key Points of NGSS Presentation

Christine Tedisky May 2015

- The information regarding curriculum and assessments for science as well as transition to NGSS timelines have NOT been formally accepted or approved by the State Board of Education or the Connecticut General Assembly.
- Next Generation Science Standards were developed in April 2013 and are based on the National Research Council's publication "A Framework for K-12 Science Education" (2012).
- Next Generation Science Standards are NOT the same as the Common Core State Standards for ELA and Math - they are a completely separate entity that have no federal funding or incentives backing them for states to adopt them.
- The Connecticut State Board of Education was presented with the Next Generation Science Standards in February 2015 for their consideration. The SBoE has requested feedback from all stakeholders in local districts (superintendents, assistant superintendents, local BoE, and families) before they make a decision on adoption of these standards - the decision could be as early as Fall 2015, but may be later.
- Key features of NGSS:
  - Standards are written as performance expectations ("Students who demonstrate understanding can...")
  - 3-dimensional each standard incorporates "practices," "crosscutting concepts," and "disciplinary core ideas"
    - Science and Engineering Practices are a clarification of the term "inquiry" they define HOW students will interact with science ideas to GATHER evidence, REASON with evidence, and COMMUNICATE explanations
    - Crosscutting Concepts are broad themes that have application across all domains of science (Cause and Effect, Structure and Function, Stability and Change, Patterns, etc.)
    - Disciplinary Core Ideas are those that have BROAD importance across multiple sciences (i.e., Physical Sciences Structure and Properties of Matter; Life Sciences Growth and Development of Organisms; Earth and Space Sciences Earth and the Solar System; Engineering Defining and Delimiting and Engineering Problem these are just a FEW examples) core ideas are revisited across the grade levels at increasing levels of complexity
  - Each standard identifies connection between ELA and Math Common Core skills
  - Engineering Design is key across all grade levels
- Assessments for these new standards have NOT been developed and are NOT part of Smarter Balanced Assessments. CMT (grades 5 and 8) and CAPT (grade 10) WILL remain as they are at least through Spring 2016, with potential for piloting NGSS-style questions in 2017 and 2018. The current thinking is that full implementation of the NGSS assessment will be in Spring 2019. Unclear about which grade levels will be assessed.
- Assessments, when developed, will assess all 3-dimensions simultaneously. Assessments will likely be computer-based, and possibly adaptive.
- Teachers should incorporate the "Science and Engineering Practices" as aligned to their current (based on CT Science Standards) curriculum at each grade level. Also, teachers should continue to engage students in discourse and evidence-based reasoning and critical thinking. Teachers should begin to move towards performance-based assessments for science. Much of this work is already being done at the secondary level.