Next Generation Science: A Standards-Based Approach to Science for the TASC

Central/Southern Tier RAEN
December 7 & 8, 2014

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Learning Objectives

- To explore the Framework of the Next Generation Science Standards
- To focus on the 11 Core Disciplinary Ideas tested on the TASC
- To use strategies and resources to engage students in science content
- To engage in hands-on science activities that can be used with students
- To explore online science unit/lesson plan sites

Agenda

- Introductions
- Objectives
- Structure of the TASC
- Next Generation Science Standards:
  - Earth and Space Science: Unraveling Earth's Early History
- PBL Learning Media:
  - Physical Science: Teaching from Space
- Scope, Sequence & Coordination:
  - Life Science: Variation & Heredity

TASC Science

	TASC
Content Area	
• **Physical Sciences**	20%
• **Earth and Space Sciences**	40%
• **Life Sciences**	40%
• **Scientific and Engineering Practices**	Integrated
• **Cross-Cutting Concepts**	Integrated
Testing Time	75 min (80 min Spanish)
Number of Questions	47 MC (8 stimuli)

TASC Test Science

- Includes items for the disciplines of Physical Sciences, Life Sciences, and Earth and Space Sciences.
- Each discipline is subdivided into several Core Ideas, which each contain multiple performance expectations.
- Each test item assesses one performance expectation. Items may require recalling knowledge, applying knowledge and skills, or reasoning.
- The number of test items per Core Idea is proportional to the number of performance expectations within the Core Idea. As a result, each Core Idea will have about 2-5 items on a given test.

TASC Test Science

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

Earth and Space Sciences
- Core Idea: HS-ESS1 Earth's Place in the Universe
- Core Idea: HS-ESS1 Earth's Systems
- Core Idea: HS-ESS1 Earth and Human Activity

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

Next Generation Science Standards

http://www.nextgenscience.org/

Cross-Cutting Concepts (from Appendix G)

- Patterns
- Cause and effect
- Scale, proportion, and quantity
- Systems and system models
- Energy and matter
- Structure and function
- Stability and change

Science and Engineering Practices (from Appendix F)

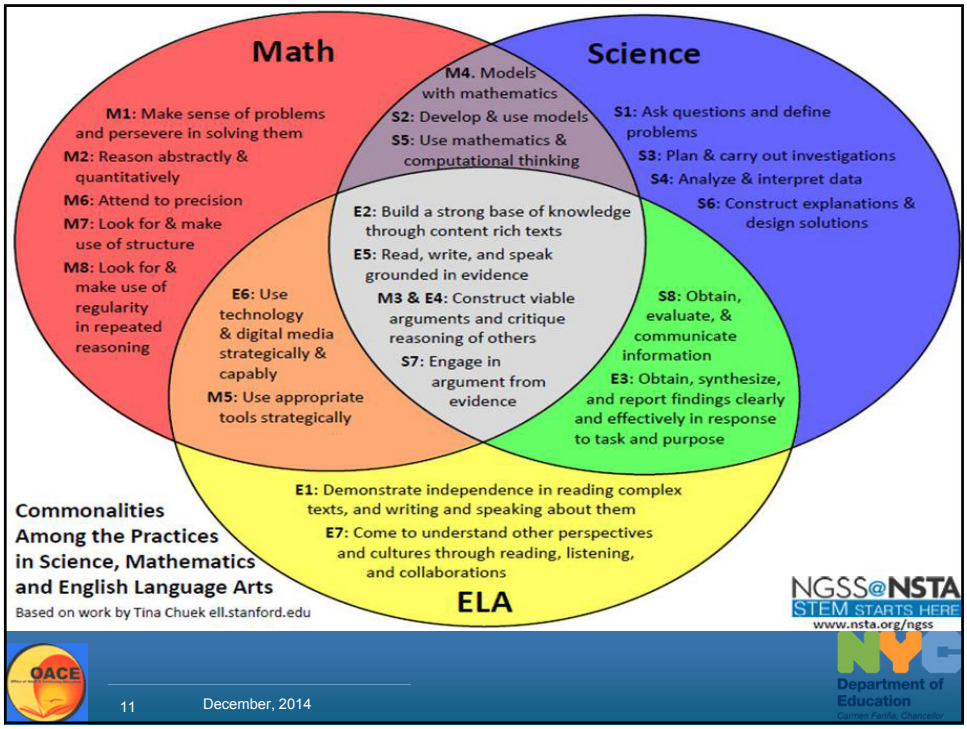
- Asking questions (for science) and defining problems (for engineering)
- Developing and using models
- Planning and carrying out investigations
- Analyzing and interpreting data
- Using mathematics and computational thinking
- Constructing explanations (for science) and designing solutions (for engineering)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

Practices in Mathematics, Science, and English Language Arts*

Math	Science	English Language Arts
M1. Make sense of problems and persevere in solving them.	**S1.** Asking questions (for science) and defining problems (for engineering).	**E1.** They demonstrate independence.
M2. Reason abstractly and quantitatively.	**S2.** Developing and using models.	**E2.** They build strong content knowledge.
M3. Construct viable arguments and critique the reasoning of others.	**S3.** Planning and carrying out investigations.	**E3.** They respond to the varying demands of audience, task, purpose, and discipline.
M4. Model with mathematics.	**S4.** Analyzing and interpreting data.	**E4.** They comprehend as well as critique.
M5. Use appropriate tools strategically.	**S5.** Using mathematics, information and computer technology, and computational thinking.	**E5.** They value evidence.
M6. Attend to precision.	**S6.** Constructing explanations (for science) and designing solutions (for engineering).	**E6.** They use technology and digital media strategically and capably.
M7. Look for and make use of structure.	**S7.** Engaging in argument from evidence.	**E7.** They come to understanding other perspectives and cultures.
M8. Look for and express regularity in repeated reasoning.	**S8.** Obtaining, evaluating, and communicating information.	

* The Common Core English Language Arts uses the term "student capacities" rather than the term "practices" used in Common Core Mathematics and the Next Generation Science Standards.

NGSS@NSTA STEM STARTS HERE



Shift in Emphasis: The NGSS…

1. Reflects the interconnected nature of science as it is practiced and experienced in the real world.
2. Are student performance expectations: NOT a curriculum.
3. Build science concepts coherently from K to 12.
4. Focus on deeper understanding of content as well as application of content.
5. Integrate application of science, technology, and engineering from K to 12.
6. Are designed to prepare students for college, career, and citizenship.
7. Are correlated to the Common Core State Standards in Mathematics and English Language Arts.

TASC Expected Science Test Design

	TASC Expected %
Prior Knowledge Required	70%
Cross-Cutting Concepts (cause-and-effect, proportion)	78%
Computation	35%

Next Generation Science Sample Tasks

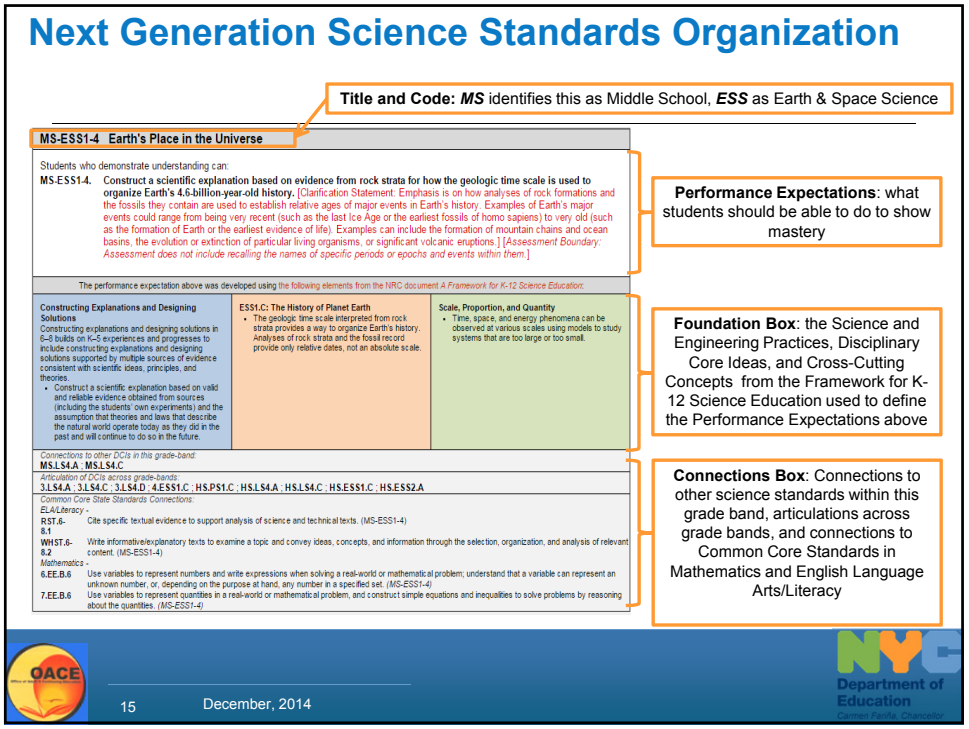
Middle School Sample Tasks

- **Antibiotic Resistance** [pdf] [Microsoft Word]
- **Four Cities** [pdf] [Microsoft Word]
- **Ocean Waves** [pdf] [Microsoft Word]
- **Watershed** [pdf] [Microsoft Word]

High School Sample Tasks

- **Analyzing Floods** [pdf] [Microsoft Word]
- **Bee Colony Numbers** [pdf] [Microsoft Word]
- **Solar Cooker** [pdf] [Microsoft Word]
- **Sub-Zero** [pdf] [Microsoft Word]
- **Unraveling Earth's Early History** [pdf] [Microsoft Word]

Next Generation Science Standards Organization



Next Generation Science Standards Organization

Science and Engineering Practices

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 (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

Disciplinary Core Ideas

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.

Crosscutting Concepts

Scale, Proportion, and Quantity

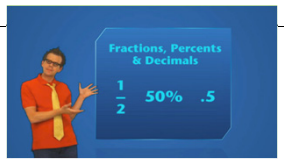
- Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small.

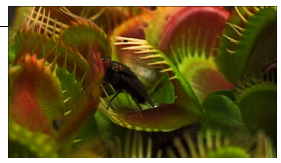
Note the Clarification Statements which supply examples or additional clarification to the performance expectations. Also note the Assessment Boundary statements, which specify the limits to large scale assessment

[Clarification Statement: Emphasis is on how analyses of rock formations and the fossils they contain are used to establish relative ages of major events in Earth's history. Examples of Earth's major events could range from being very recent (such as the last Ice Age or the earliest fossils of homo sapiens) to 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.*]

PBS LearningMedia | New York

A service of New York's Public Television Stations

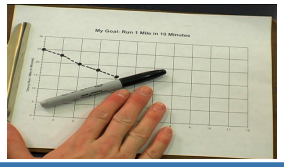




Empowering Educators

Engaging Students

Transforming Learning



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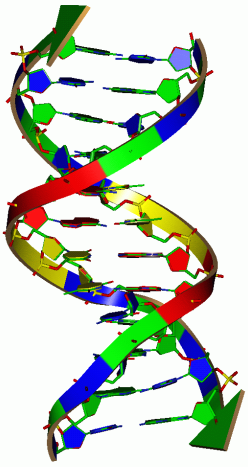
Education is in PBS' DNA

- PBS is America's largest and most trusted classroom
- More than **220 million kids and adults nationwide** engage with PBS programming and content
- Their involvement in education goes **far beyond broadcast into the digital space**
- PBS is a leading source of digital learning tools for grades PreK-12 classrooms - the gateway for educators to access these resources is through **PBS LearningMedia**



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A Look Inside PBS LearningMedia

Designed to improve teacher effectiveness & student achievement

Digital media library of 75,000+ classroom-ready, curriculum targeted resources

Over 1.5 million users currently have registered access

2013 SIIA CODiE Winner for Best K-12 Solution and Best Education Reference Solution

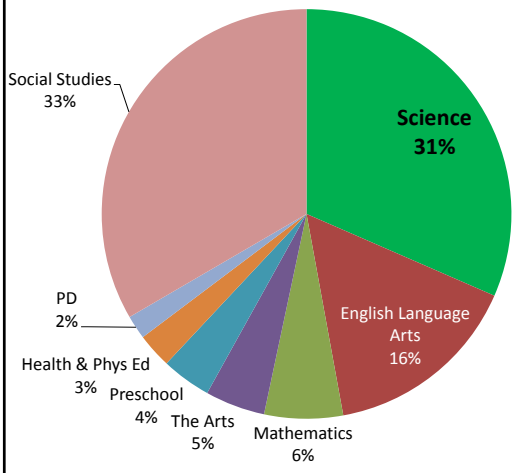
2014 EdTech Digest Winner for Best e-Learning Solution

Resource collection includes videos, lesson plans, interactive games, audio clips, essays, and discussion questions

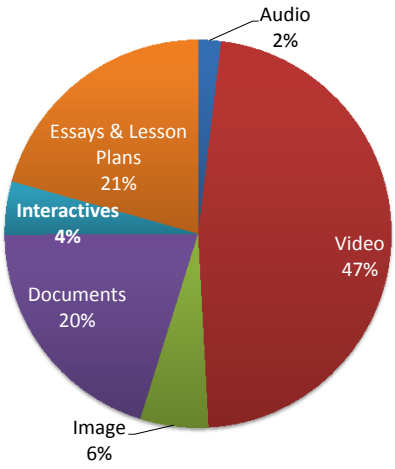
Content is drawn from over 165 trusted media partners that include PBS, NASA, NPR, among others

Content is mapped to National and Common Core State Standards

Resources by Subject Area



Resources by Media Type



PBS Learning Media

- Self-registration, free of charge
- Feature box
- Browse Standards Box
- Browse by Grade and Subject Box
- Search:
  - turn images off
  - sort by…
  - filter by Grade, Subject, Media Type, Language, Permitted Use
- Closed Captioning
- Download or stream
- Add to Favorites
- Manage Folders

Site Demo

Scope, Sequence, and Coordination

http://dev.nsta.org/ssc/

The NSF-funded project on Scope, Sequence, and Coordination of Secondary School Science (SS&C) was initiated by the National Science Teachers Association (NSTA)

The 5Es Instructional Model

Engage:

- First engage your students by an event or question related to the concept that you plan to introduce. This provides you with the opportunity to find out what students already know or what they think they know about the topic and concepts to be developed.

Explore:

- Next allow your students to participate in activities to explore the concept. This exploration provides students with a common set of experiences and a broad range of experiences within which students can compare what they think about what they are observing and experiencing.

Explain:

- Provides opportunities for students to connect their previous experienced and to begin to make conceptual sense of the main ideas of the module. This stage allows for the introduction of formal language, scientific terms, and content information that might help to clarify concepts and make students' previous experiences easier to describe and explain.

Elaborate:

- Allow the students to elaborate and build on their understanding of concepts by extending them, applying them to new situations, and relating their previous experiences to new ones.

Evaluate:

- The evaluation of students' conceptual understanding and ability to use skills begins with the engage and continues throughout each stage of the model. Combined with the students' written work and performance of tasks throughout the module, the evaluate lesson can serve as a summative assessment of what students know and can do at this point.

Discussion Group Process

- **Read the text carefully.** Your opinions are important, but these opinions are your thoughts about the text.
- **Listen to what others say and don't interrupt.** A discussion cannot occur if what people have said has not been listened to carefully.
- **Speak clearly.** For others to respond to your opinions everyone must be able to hear and understand what you say.
- **Give others your respect.** A discussion is a cooperative exchange of ideas and not an argument or debate.
- **Talk to the group.** You may become excited and wish to share your ideas but in a Touchstones class this is done publicly for the whole class.
- **You have a responsibility to participate** but no one raises hands.

Discussion Class Procedure

1. **Everyone sits in a circle, including the teacher.**
2. **The teacher is a member of the group but is not the authority who gives the correct answers.**
3. **Facilitator reads the text aloud to the students.**
4. **Each student writes a question about the reading.**
5. **Students read aloud their questions.**
6. **Facilitator selects one question for discussion.**
7. **Open discussion for 15-20 minutes.**

TAPPS: Thinking Aloud Paired Problem Solving

Speaker:

- Say aloud everything you are thinking as you solve the problem

Listener:

- Take notes on what your speaker is saying
- Remind the speaker to talk if there is silence
- You may ask clarifying questions, but do not help solve the problem
- Be prepared to share what you heard

Online Resources

- Next Generation Science Standards:

  http://www.nextgenscience.org/

  http://www.nextgenscience.org/classroom-sample-assessment-tasks
- PBS Learning Media

  http://ny.pbslearningmedia.org/
- Scope, Sequence, and Coordination Micro-units

  http://dev.nsta.org/ssc/
- CTB McGraw-Hill's TASC webpage:

  http://www.tasctest.com/