Next Generation Science Standards

Answering the Nation’s Call for STEM Literacy
Next Generation Science Standards

Answering the Nation’s Call for STEM Literacy

Tim Crockett, Senior Advisor, Measured Progress
Next Generation Science Standards

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NEXT GENERATION SCIENCE STANDARDS
For States, By States
Next Generation Science Standards

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Next Generation Science Standards

Development

- Who was involved?
- What was the vetting process?
- What’s the connection?
- What are the differences and similarities?
Next Generation Science Standards

IMPLICATIONS
Next Generation Science Standards
Next Generation Science Standards
National Education Initiatives
National Education Initiatives

- ESEA
- NDEA

Timeline:
- 1950
- 1960
- 1970
- 1980
- 1990
- 2000
- 2010

Images of key figures associated with these initiatives.
National Education Initiatives

- ESEA
- NDEA
- NAEP
- A Nation At Risk:

National Education Initiatives

1950
1960
1970
1980
1990
2000
2010

ESEA

NDEA

NAEP

A Nation At Risk:

The Nation's Goals Report

Measured Progress ©2014
National Education Initiatives

- ESEA
- NDEA
- NAEP
- A Nation At Risk
- Science Education
- Goals Report

Timeline:
- 1950
- 1960
- 1970
- 1980
- 1990
- 2000
- 2010

Carnegie Report

Carnegie Foundation
for the Advancement of Teaching

Researchers

Public Sector

Private Sector

Evaluate Science and Mathematics Education
Carnegie Report

S.T.E.M.
- Science
- Technology
- Engineering
- Mathematics
2012 PISA Assessment

Science

Mean score - 2012

United States: 497 points

- United Kingdom: 514
- Germany: 524
- Vietnam: 528
- Singapore: 551
- China (Shanghai): 580
2012 PISA Assessment

Mathematics

Mean score – 2012
United States: 481 points

- United Kingdom: 494
- Vietnam: 511
- Germany: 514
- Singapore: 573
- China (Shanghai): 613
Demand for STEM literacy
Demand for STEM literacy
The Facts

- In 2010, foreign competitors submitted over half of technology-related U.S. patent applications
The Facts

- In 2010, foreign competitors submitted over half of technology-related U.S. patent applications
- China is now the largest exporter of high-tech products
The Facts

- In 2010, foreign competitors submitted over half of technology-related U.S. patent applications.
- China is now the largest exporter of high-tech products.
- The U.S. now ranks 11th out of 36 countries in high school graduation rates.
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Peter J. McLaren,
Science and Technology Specialist,
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Next Generation Science Standards

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Peter J. McLaren,
Committee for Developing Assessment of Science Proficiency in K–12
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Council of State Science Supervisors

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NEXT GENERATION SCIENCE STANDARDS
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NEW ENGLAND COMMON ASSESSMENT PROGRAM
RHODE ISLAND INTERIM ASSESSMENT
Next Generation Science Standards

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Next Generation Science Standards
For States, By States
Developing the Next Generation Science Standards
Next Generation Science Standards
Next Generation Science Standards

- Elementary, Middle, and High School Science Teachers
- Workforce Development Authorities
- State Science Experts
- State Assessment Experts
Next Generation Science Standards

Development Timeline

- **First Draft Creation and Internal Review**: 2011
- **College and Career Ready Review**: 2012
- **Final Version Released for Adoption**: 2013
- **First Draft Out for Public Comment**: 2014
- **Second Draft Out for Public Comment**: 2013
Next Generation Science Standards

Educator, State, and Public Involvement
Next Generation Science Standards

NO FEDERAL FUNDS
Next Generation Science Standards

NO FEDERAL FUNDS

Carnegie Foundation for the Advancement of Teaching

NRC

Achieve
Next Generation Science Standards
Next Generation Science Standards

ARC
Achieve
AAAS
NSTA National Science Teachers Association
Next Generation Science Standards
Next Generation Science Standards

Four Domains

- Life Sciences
- Physical Sciences
- Earth and Space Sciences
- Engineering and Technology
Next Generation Science Standards
Next Generation Science Standards

“Learning is defined as a combination of both knowledge and practice, not separate content and process learning goals.”

NRC Framework, p. 254
<table>
<thead>
<tr>
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<th></th>
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<tbody>
<tr>
<td>▪ <strong>Distinguish</strong> between atoms and molecules.</td>
<td>▪ <strong>Develop molecular-level models</strong> of a variety of substances, comparing those with simple molecules to those with extended structures.</td>
</tr>
<tr>
<td>▪ <strong>Describe</strong> the difference between pure substances (elements and compounds) and mixtures.</td>
<td>▪ <strong>Design a solution</strong> that solves a practical problem by using characteristic chemical and physical properties of pure substances.</td>
</tr>
<tr>
<td>▪ <strong>Distinguish</strong> between physical and chemical properties of matter as physical (i.e., density, melting point, boiling point) or chemical (i.e., reactivity, combustibility).</td>
<td>▪ <strong>Develop a molecular-level model</strong> that depicts and predicts why either temperature change and/or change of state can occur when adding or removing thermal energy from a pure substance.</td>
</tr>
<tr>
<td>▪ <strong>Distinguish</strong> between changes in matter as physical (i.e., physical change) or chemical (development of a gas, formation of precipitate, and change . . .</td>
<td>▪ <strong>Develop molecular models</strong> of . . .</td>
</tr>
</tbody>
</table>
Next Generation Science Standards

✓ Internationally Benchmarked
Next Generation Science Standards

Not equal

Common Core State Standards Initiative
Preparing America's Students for College & Career
Next Generation Science Standards

For States, By States

Common Core State Standards Initiative

Preparing America’s Students for College & Career

ALIGNED
Next Generation Science Standards

- States
- Educators
- Creation
- Science Community
Next Generation Science Standards

Implementation

States

Educators

Science Community
Next Generation Science Standards

NSTA
National Science Teachers Association
Next Generation Science Standards

“. . . long-term systemic effort that requires significant changes in

- Instruction,
- Curriculum,
- Assessment,
- Teacher preparation, and
- Professional development

—accompanied by extensive financial, administrative and public support.”
Next Generation Science Standards

- State and district policymakers
Next Generation Science Standards

- State and district policymakers
- Administrators
Next Generation Science Standards

- State and district policymakers
- Administrators
- Science educators
Next Generation Science Standards

- State and district policymakers
- Administrators
- Science educators
- Community members
Next Generation Science Standards

- State and district policymakers
- Administrators
- Science educators
- Community members
- Higher education
Next Generation Science Standards

- Instruction
Next Generation Science Standards

- Instruction
- Curriculum
Next Generation Science Standards

- Instruction
- Curriculum
- Teacher preparation and professional development
Next Generation Science Standards

- Instruction
- Curriculum
- Teacher preparation and professional development
- Assessment
Next Generation Science Standards

The Implications of Next Generation Science Standards on Assessment

Susan Tierney,
Product Manager – Science,
Measured Progress
The Implications of Next Generation Science Standards on Assessment
Next Generation Science Standards

☑ Evidence
Next Generation Science Standards

- Evidence
- Application
Next Generation Science Standards

Recall Facts
Next Generation Science Standards

Back then...
Next Generation Science Standards

Kinetic and Potential Energy
Next Generation Science Standards

Kinetic and Potential Energy

Greatest Potential Energy

Greatest KINETIC Energy
Next Generation Science Standards

Kinetic and Potential Energy

Greatest Potential Energy

Greatest KINETIC Energy
Next Generation Science Standards

Kinetic and Potential Energy

And now?
Next Generation Science Standards

Kinetic and Potential Energy

- Present a problem for students to solve
Next Generation Science Standards

Kinetic and Potential Energy

- Present a problem for students to solve
- Emulate how scientists think and act
Next Generation Science Standards

Kinetic and Potential Energy

- Present a problem for students to solve
- Emulate how scientists think and act
- Focus on gathering evidence and making thinking visible
Next Generation Science Standards

You’re probably already assessing students in ways that mirror the Next Generation Science Standards.
Next Generation Science Standards

Carbon moves between living and nonliving things in every ecosystem.

Draw a diagram to show how carbon moves among the following living and nonliving things in an ecosystem.

- Lynx
- Rabbit
- Grass
- Atmosphere
- Fungi

In your diagram, be sure to label the organism and the direction of carbon movement.
Next Generation Science Standards

MS-LS2-3
(NGSS Performance Expectations):

Develop a **model** to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.
Next Generation Science Standards

- Provide or identify evidence
- Explain thinking
Next Generation Science Standards

**MS-ESS1-4 (NGSS Performance Expectations):**
Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth’s 4.6-billion-year-old history.

The diagrams to the right represent four rock layers. The age of each rock layer is labeled.

A student claims that **Layer S** was formed at the same time a band of rock cut across **Layer V**.

Using evidence from the diagrams, explain whether you support or do not support the student’s claim.
Next Generation Science Standards

SCIENCE

ENGINEERING
Next Generation Science Standards

**MS-ESS3-2 (NGSS Performance Expectations):**
Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
Next Generation Science Standards

Levees—long piles of earth, rock, or concrete—help prevent rivers from overflowing their banks. They are used to manage water levels in rivers—preventing loss of life and property in areas prone to flooding.

Which data would best be used to evaluate whether levee technology would be a solution for managing water levels in a specific location?

A. Average volume of a river at a specific location
B. Length of a river and total population along the river
C. Daily rainfall for the past 30 days and the number of businesses affected
D. Range of precipitation and amount of property loss due to flooding over the past 20 years
Next Generation Science Standards
Next Generation Science Standards

Use items for summative assessment and formative practice
Next Generation Science Standards

Multiple types of assessment needed
Next Generation Science Standards

There is no one-size-fits-all assessment solution
Next Generation Science Standards

**Testlets**
- Small preconfigured groups of items that address specific performance expectations
- Can be used to provide formative feedback
Next Generation Science Standards

Curriculum-Embedded Performance Assessments

- Multi-day projects, investigations, or problem-solving activities
Next Generation Science Standards

Curriculum-Embedded Performance Assessments

- Multi-day projects, investigations, or problem-solving activities
- Cover more than one Performance Expectation at a time
Next Generation Science Standards

Curriculum-Embedded Performance Assessments

- Multi-day projects, investigations, or problem-solving activities
- Cover more than one Performance Expectation at a time
- Should not cut into instructional time
Next Generation Science Standards

Moving students from recall to applied practice of concepts
Next Generation Science Standards

Next Generation Science Assessment Pilot Program

ProductManagementGroup@measuredprogress.org
Questions?

ProductManagementGroup@measuredprogress.org
Thank You for attending!

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