# NEXT GENERATION SCIENCE STANDARDS

For States, By States

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# The Need to Improve Science Education: Why Now? An Overview

# Science Skills are in Demand

- Students will face unprecedented competition in the workforce not only within their home states, but also from foreign countries.
  - By 2015, nearly 60% of the new jobs being created will require skills currently being mastered by only 20% of the population, according to a recent report from the American Society for Training and Development.
  - According to the same report, job skills in STEM—science, technology, engineering and math—are among the skills experiencing the greatest increase in demand. In 1991, fewer than 50% of U.S. jobs required skilled workers. By 2015, 76% of all newly created U.S. jobs will require highly-skilled workers, with some proficiency in STEM.

# Science Literacy in the 21st Century

- The definition of what it means to be “literate” in science continues to grow and includes the use of technology, critical thinking and analytical skills.
- As citizens, we are increasingly asked to make decisions on issues ranging from healthcare to the environment, where literacy in science is essential.
- Science literacy and the skills developed in the science classroom will help students improve performance and understanding in other subjects, including math and reading.

# U.S. Students are Lagging Behind

- According to 2012 results from the Program for International Student Assessment (PISA), U.S. students ranked 20th in science compared to their peers in other countries.
- According to a 2011 ACT report, only 30% of U.S. high school graduates in 2011 were ready for college coursework in science.

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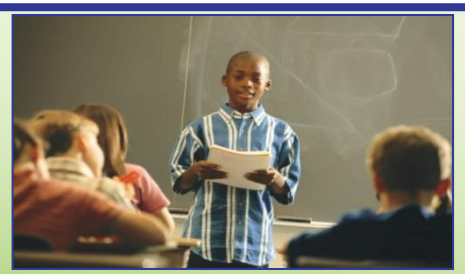
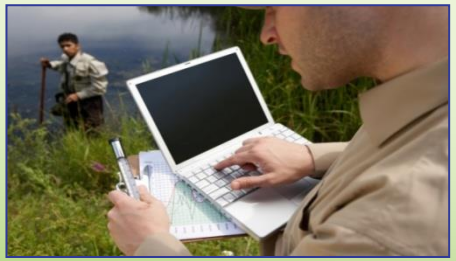
# Since States Last Updated their Science Standards…



- GPS goes mainstream
- Text messaging introduced by AT&T
- Pluto is reclassified as a dwarf planet
- Apple releases the iPhone
- NASA Rovers discover evidence of water on Mars
- Robotic limbs with advanced movement by connecting electrodes and wires to human nerve endings
- Creation of the first synthetic genome for a bacterial cell
- Google was founded

# Strong Science Education = College and Career Readiness



- A high-quality, robust science education means students learn more and will develop skills -- communication, collaboration, inquiry, problem-solving, flexibility -- that will serve them throughout their educational and professional lives.
- Teachers who apply the principles of high quality STEM instruction are able to teach students in the ways they learn best – in a hands-on, collaborative, and integrated environment rooted in inquiry and discovery.

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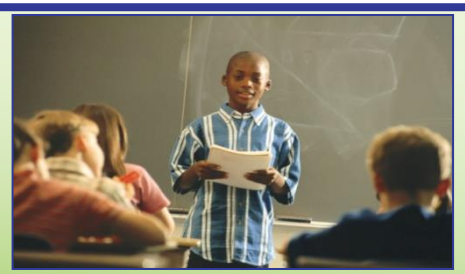
# The History of Standards

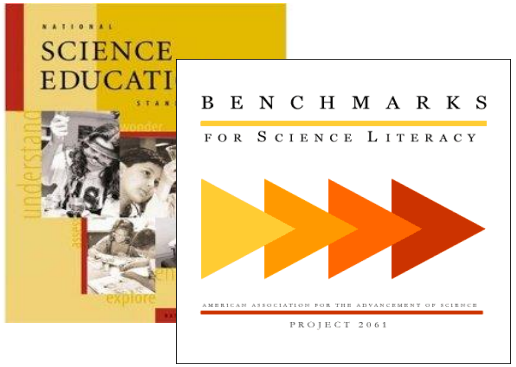
# History of State Standards



**State standards have been part of the education policy landscape for more than 20 years.**

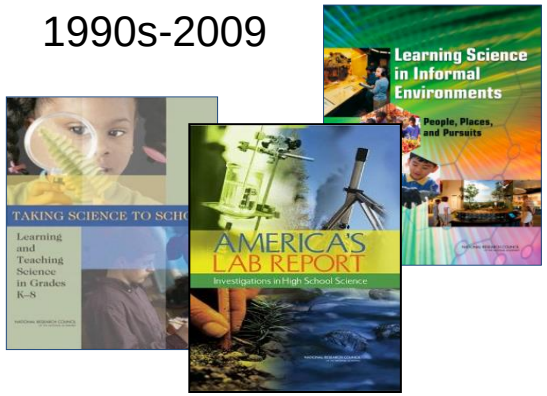
- **1983:** *A Nation at Risk* issues a call to arms for state leaders to raise the expectations for their education systems — the defining moment for the standards-based education reform movement.
- **1989:** Education Summit establishes education goals in core subject areas and calls on states to set academic standards as a first step in restructuring K–12 education systems.
- **By 2000:** Nearly every state has developed standards in core subject areas, and many have revised standards at least once.

# Evolution of State Science Standards

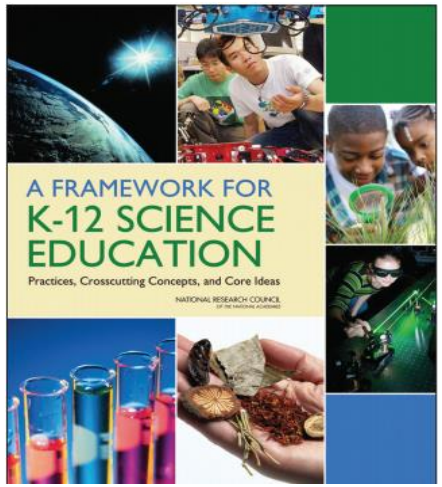



1990s

1990s-2009




Phase I




1/2010 - 7/2011

Phase II

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7/2010 – April 2013

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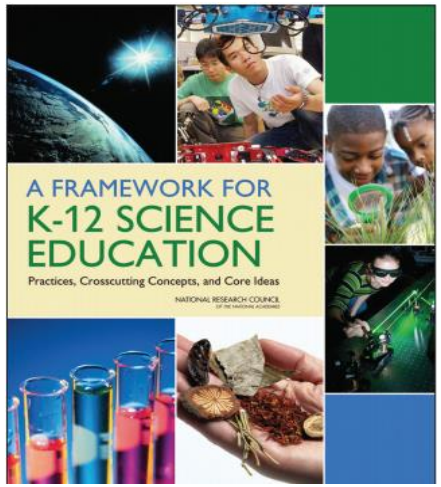
# Purpose of State Standards

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- Assessment
- Curricula
- Instruction
- Teacher development

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# Developing the NGSS

# Partners in the Development of the Framework and NGSS

THE NATIONAL ACADEMIES
*Advisers to the Nation on Science, Engineering, and Medicine*

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Achieve

NSTA National Science Teachers Association

AAAS
ADVANCING SCIENCE, SERVING SOCIETY

# By States, For States

- The NGSS are a new set of K-12 science education standards developed by states, for states.
- The NGSS identify science and engineering practices and content that all K-12 students should master in order to be prepared for success in college and 21st-century careers.
- The NGSS are based on *A Framework for K-12 Science Education* developed by the National Research Council.

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# By States, For States

- The NGSS were built upon a vision for quality science education for ALL students, not just a select few.
- The NGSS are not curricula. The standards articulate what students need to know and be able to do by the end of each grade level.
- The NGSS were benchmarked against countries whose students perform well in science and engineering.

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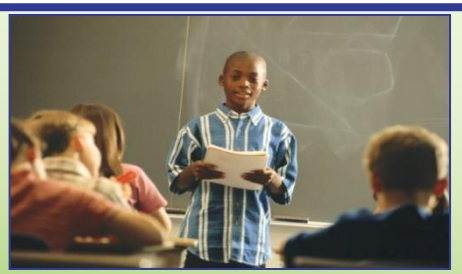
# Process for Development of Next Generation Science Standards



- **States and other key stakeholders were engaged in the development and review of the NGSS**
  - State-Led Process
    - 26 Volunteer Lead State Partners
  - Writing Team
    - 41 educators, scientists, and engineers from across the country
  - Critical Stakeholder Team
    - Education, science, business and industry, as well as the general public -- including, in some cases, parents and students.

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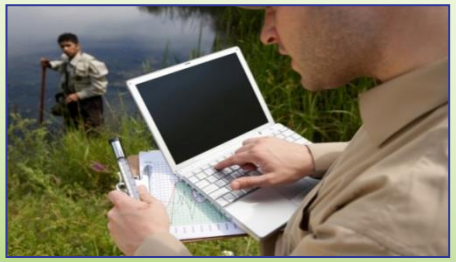
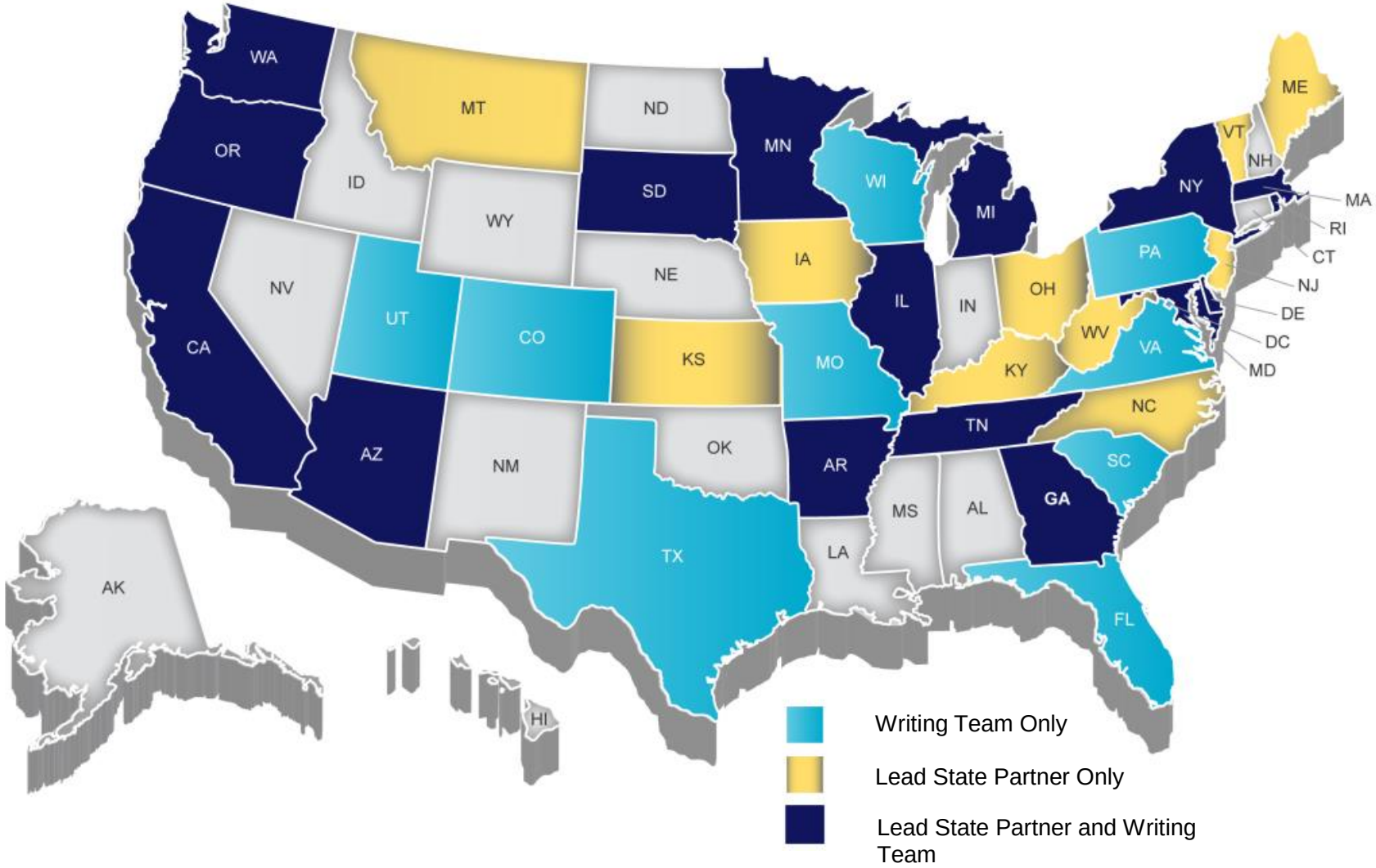
# Lead State Partners and NGSS Writing Team



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# Incorporating Feedback

- 3 State and Critical Stakeholder Review Periods
  - Winter 2012, Fall 2012, Winter 2013
- 2 Public Review Periods
  - Spring 2012, Winter 2013

*The draft standards received comments from more than 10,000 individuals*

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# Release and Adoption

- The NGSS were released April 2013 after passing a fidelity review by the National Research Council which ensured the NGSS were consistent with the vision outlined in *A Framework for K-12 Science Education*.

- As of December 2014, 13 states and the District of Columbia have adopted: California, Delaware, Illinois, Kansas, Kentucky, Maryland, New Jersey, Nevada, Oregon, Rhode Island, Vermont, Washington and West Virginia.

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# A Framework for K-12 Science Education

# Framework Vision (Summary)

- New learning builds on previous knowledge, skills and instruction
- Focuses on a limited number of core ideas, but each in greater depth
- Emphasizes integration of content knowledge and the practices

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# Principles of the Framework

- Children are born investigators
- Understanding builds over time
- Science and engineering require both knowledge and practice
- Connecting to students' interests and experiences is essential
- Focusing on core ideas and practices
- Promoting equity

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# Scientific and Engineering Practices

# Scientific and Engineering Practices

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

*Framework pp.41-82*

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# Crosscutting Concepts

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

*Framework pp.83-102*

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# Disciplinary Core Ideas

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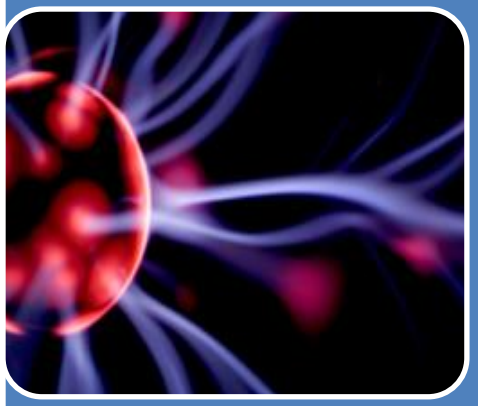
## Physical Science

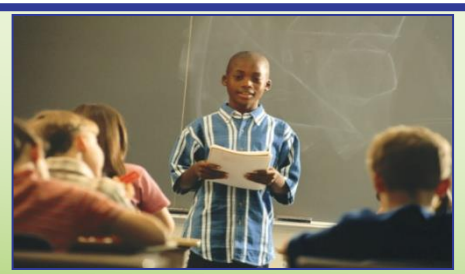


- PS1: Matter and Its Interactions
- PS2: Motion and Stability: Forces and Interactions
- PS3: Energy
- PS4: Waves and Their Applications in Technologies for Information Transfer

## Life Science

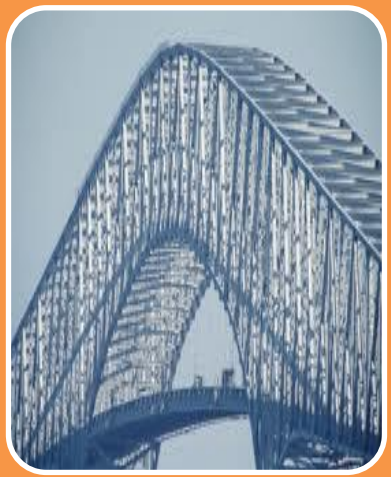
- LS1: From Molecules to Organisms: Structure and Processes
- LS2: Ecosystems: Interactions, Energy, and Dynamics
- LS3: Heredity: Inheritance and Variation of Traits
- LS4: Biological Evolution: Unity and Diversity

# Disciplinary Core Ideas (cont.)



## Earth and Space Science

- ESS1: Earth's Place in the Universe
- ESS2: Earth's Systems
- ESS3: Earth and Human Activity



## Engineering, Technology, and Applications of Science

- ETS1: Engineering Design
- ETS2: Links Among Engineering, Technology, Science, and Society

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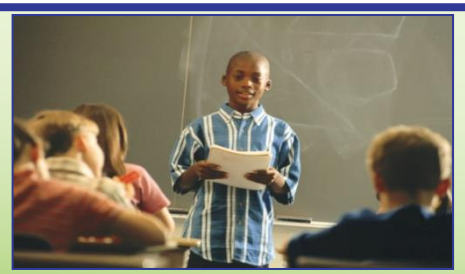
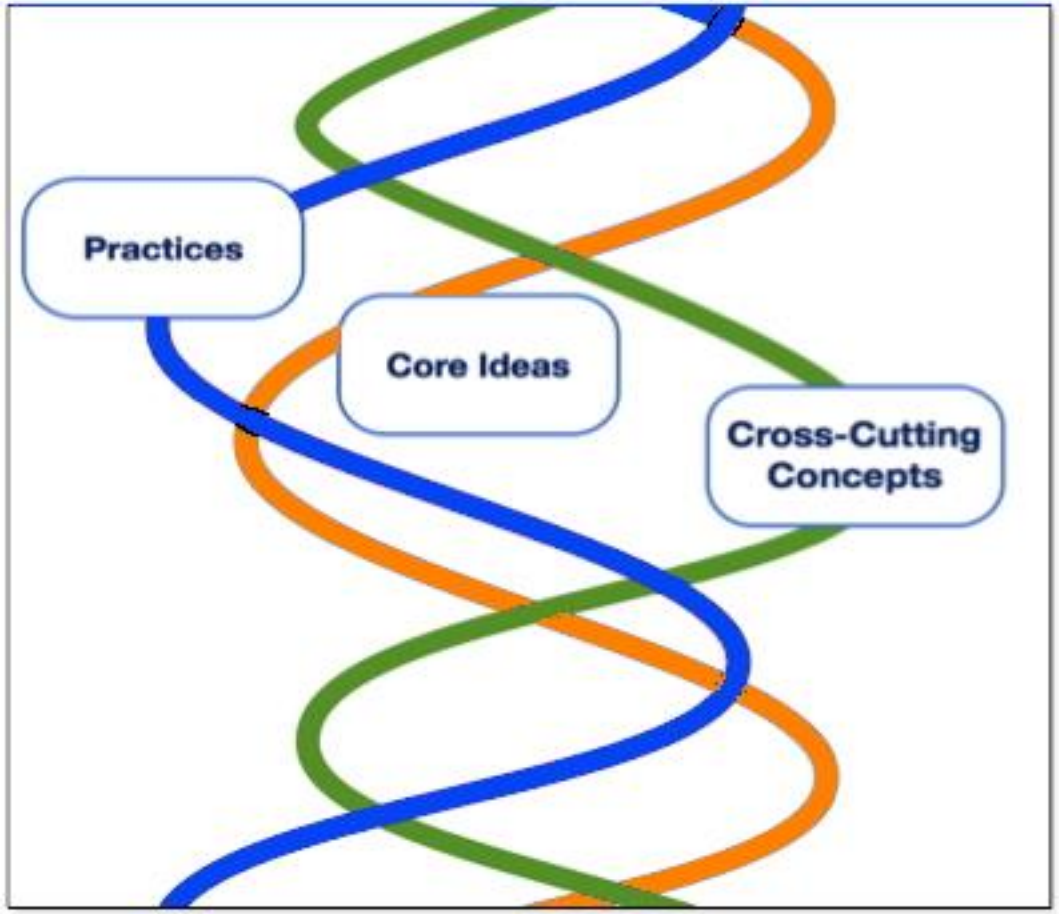
# What's Different about the Next Generation Science Standards?

# Three Dimensions Intertwined






- Performance Expectations
- The Framework requires contextual application of the three dimensions by students.
- Focus is on how and why as well as what

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# Conceptual Shifts in the NGSS

- K-12 science education should reflect the interconnected nature of science as it is practiced and experienced in the real World.
- The Next Generation Science Standards are student performance expectations – NOT curriculum.
- The science concepts build coherently from K-12.
- The NGSS focus on deeper understanding of content as well as application of content.
- Science and engineering are integrated in the NGSS from K–12.
- NGSS content is focused on preparing students for the next generation workforce.
- The NGSS and Common Core State Standards (English Language Arts and Mathematics) are aligned.

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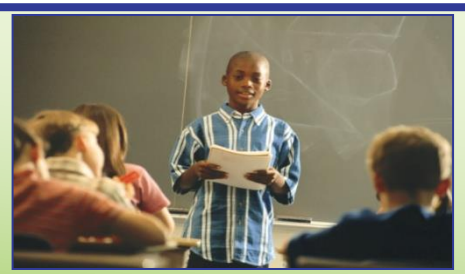
# Moving from Standards to Instruction

# Instruction Builds Toward PEs



## Performance Expectation

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# Instructional Shifts in the NGSS

- Focus on big picture, not lessons
- New learning builds on previous knowledge, skills and instruction
- Evidence of learning

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# What's Next in Our State?

- Curriculum is being developed locally; classroom materials will be selected locally.
- State and districts supporting schools and teachers in the upcoming transition to new standards
- Professional development opportunities for teachers around higher expectations in K-12 science
- Parents engaged early on about changes coming to science classrooms and how they can support students

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