# NGSS

Copper Country ISD Area Wide Conference
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NEXT GENERATION SCIENCE STANDARDS

- All CCISD Conference PowerPoints and resources will be posted on www.copperisd.org/prof_development.html
- NGSS  www.nextgenscience.org
- K-12 Framework for Science Education

www.nap.edu/catalog.php?record_id=13165

# Development NGSS

- Through a collaborative, state-led process, new K-12 science standards are being developed that will be rich in content, arranged in a coherent manner across grades and provide all students access to a challenging science education.
- The Next Generation Science Standards will be based on the *Framework for K-12 Science Education* developed by the National Research Council.

# Development of NGSS

- 20 lead partner states were selected based on a set of specific criteria to lead the development of standards, render policy advice, and participate in implementation planning.

# Role of Lead State

Lead Partner States (through State Superintendent and State Board of Education Chair signature) agreed to:

- –seriously consider adopting the *Next Generation Science Standards as presented*
- –participate in Multi-State Action Committee meetings of the Chief State School Officers to discuss adoption and implementation
- –commit SEA staff time to actively participate in the standards development process and planning for implementation
- –make public that the state is part of the NGSS effort and make transparent the state's process for receiving feedback
- –identify a state lead and form broad-based committee

# Features of Lead States

As a whole group, Lead Partner States have the following characteristics

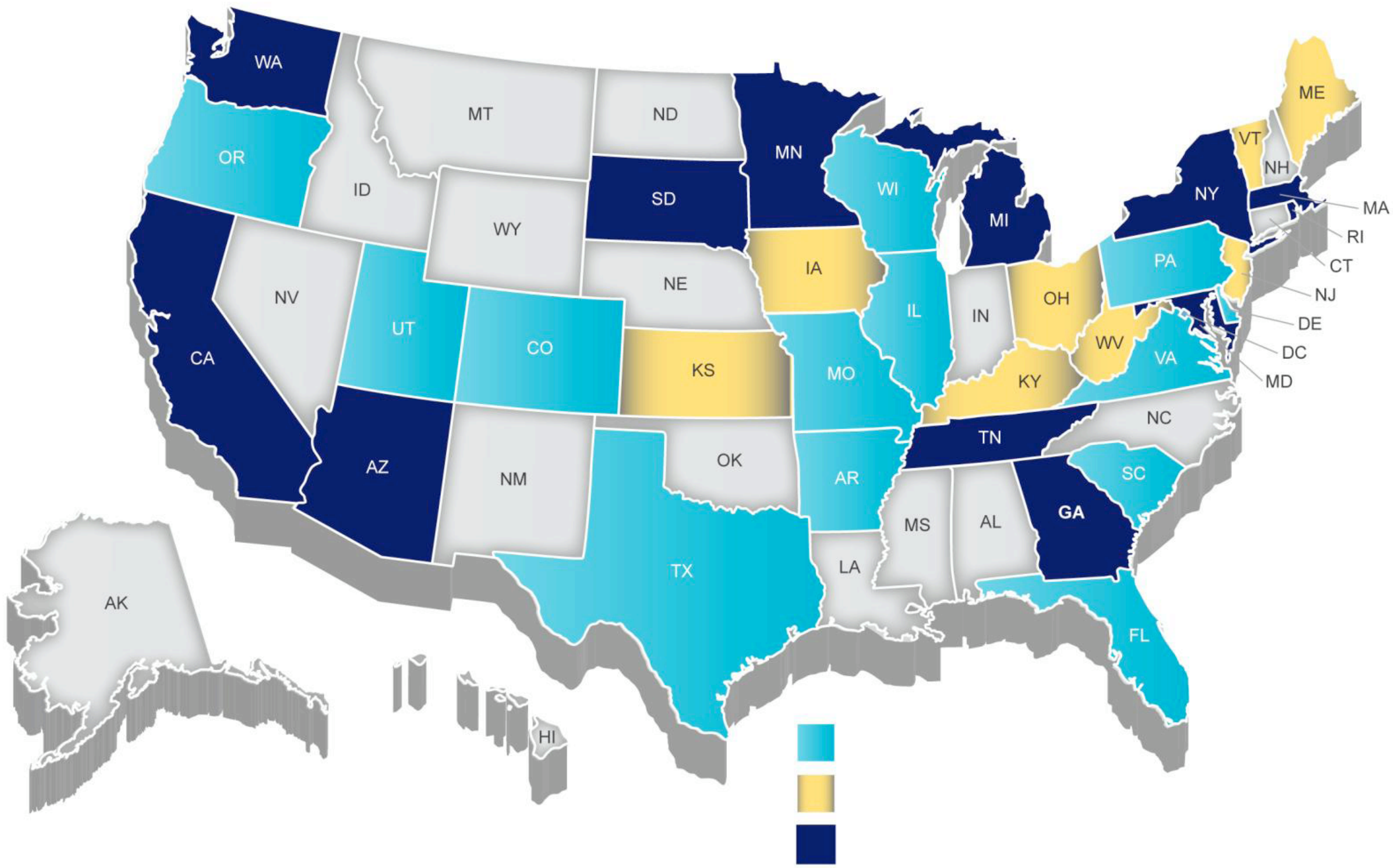
- Broad Geographic Representation
- Account for 48% of the nation's public school students
- A bipartisan collection of states based on current governor
- Are in one of the assessment consortia
- Slightly more than half have grade-by-grade standards through grade eight
- Most require three years of science for high school graduation

# NGSS Writing Team

Will write the standards based on the NRC's *A Framework for K-12 Science Education*

- 40 members with expertise in teaching at all grade levels, working with students with disabilities, English language acquisition, state level standards/assessment, workforce development, engineering, technology, and life, earth and physical science
- Includes prominent scientists and academics that have working knowledge of science standards
- Selected based on recommendations from various groups including NSTA and the Council of State Science Supervisors
- Led by the education community

Dark Blue- Lead Partner and Writing Team States
Light Blue- Writing Team States only
Yellow- Lead States only



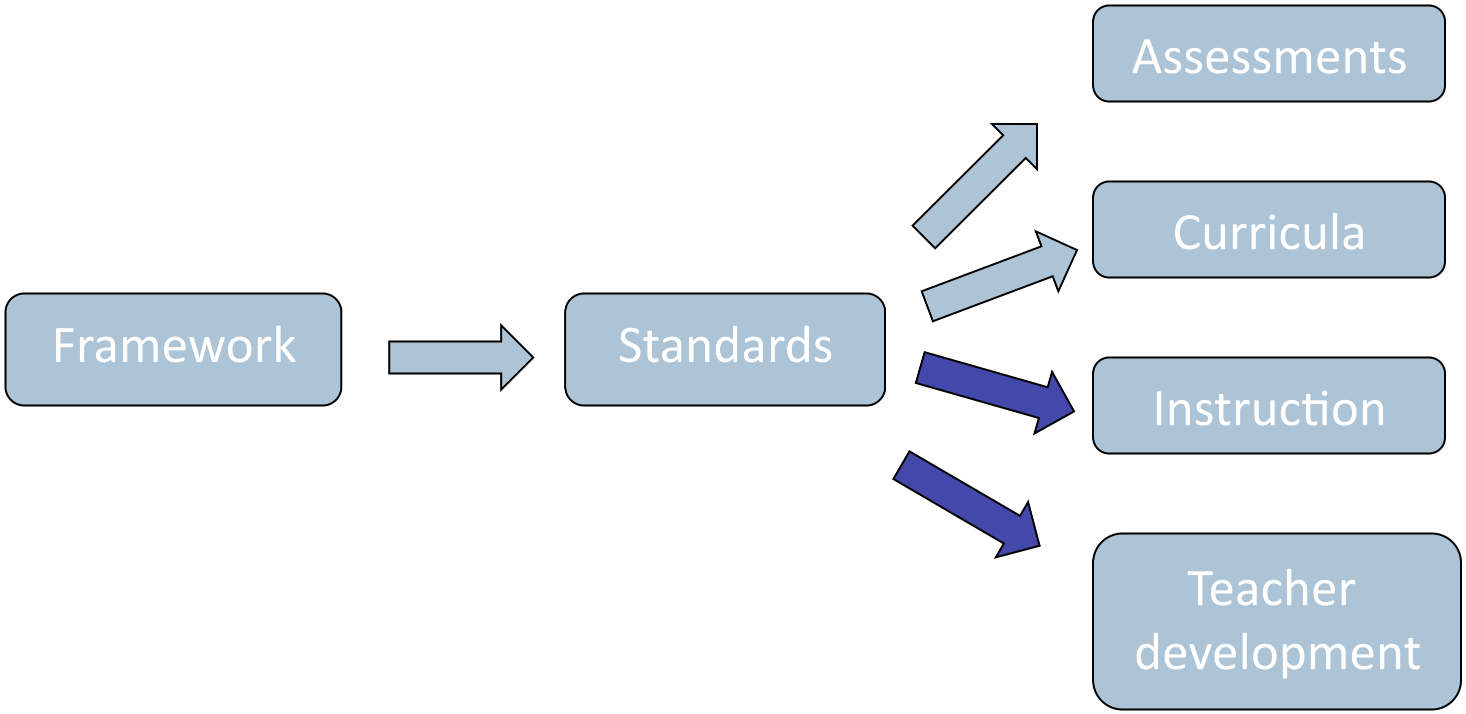
# NGSS Proposed Timeline

- September 2011- Lead States Announced
- February 2012- First Public Draft
- September 2012- Final Public Draft available for review.
- December 2012- Completion of NGSS
- January 2013- Adoption by Lead States

# More Information

NEXT GENERATION
SCIENCE
STANDARDS

www.nextgenscience.org


Framework
Standards
Assessments
Curricula
Instruction
Teacher development

## Principles of the K-12 Framework for Science Education- National Research Council

- 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

# Structure of the Framework

- Part I: A Vision for K-12 Science Education
- Part II: Dimensions of the Framework
- Part III: Realizing the Vision

# Vision: Science for All Students

- Science, engineering and technology are cultural achievements and a shared good of humankind
- Science, engineering and technology permeate modern life
- Understanding of science and engineering is critical to participation in public policy and good decision-making
- National need

# Vision: Coherent learning

- Coherent investigation of core ideas across multiple years of school
- More seamless blending of practices with core ideas and crosscutting concepts

## Three Dimensions

- Scientific and engineering practices
- Crosscutting concepts
- Disciplinary core ideas

# Scientific and Engineering Practices

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 information and computer technology
6. Developing explanations and designing solutions
7. Engaging in argument
8. Obtaining, evaluating, and communicating information

## Scientific, Engineering, Mathematics and Literacy Practices

1. Asking questions (science) and defining problems (engineering)

Math CCSS – Make sense of problems and persevere in solving them

2. Developing and using models

Math CCSS – Model with mathematics

Math CCSS – Look for and make sense of structure

3. Planning and carrying out investigations

ELA CCSS – Build strong content knowledge through research

# Scientific, Engineering, Mathematics and Literacy Practices

4. Analyzing and interpreting data

Math CCSS - Look for and express regularity in repeated reasoning

5. Using mathematics, (information and computer technology), and computational thinking

Math CCSS

- Reason abstractly and quantitatively
- Use appropriate tools strategically
- Attend to precision
- Look for and express regularity in repeated reasoning

## Scientific, Engineering, Mathematics and Literacy Practices

6. Constructing explanations (science) and designing solutions (engineering)

Math CCSS – Make sense of problems and persevere in solving them

7. Engaging in argument from evidence

Math CCSS – Construct viable arguments and critique the reasoning of others

ELA CCSS – Respond to varying demands of audience, purpose, task, and discipline in writing and speaking (adjust purpose, appreciate nuance, provide evidence as appropriate to discipline)

# Scientific, Engineering, Mathematics and Literacy Practices

8. Obtaining, evaluating, and communicating information

ELA CCSS – Demonstrate independence in "the 4 Cs"

- Comprehend complex text
- Critique the craft used to create text
- Construct rich understandings of content
- Convey multifaceted meaning

# Crosscutting Concepts

1. Patterns
2. Cause and effect
3. Scale, proportion and quantity
4. Systems and system models
5. Energy and matter
6. Structure and function
7. Stability and change

A core idea for K-12 science instruction is a scientific idea that:

- Has broad importance across multiple science or engineering disciplines or is a key organizing concept of a single discipline
- Provides a key tool for understanding or investigating more complex ideas and solving problems
- Relates to the interests and life experiences of students or can be connected to societal or personal concerns that require scientific or technical knowledge
- Is teachable and learnable over multiple grades at increasing levels of depth and sophistication

## Disciplinary Core Ideas: Physical Sciences

- PS1  Matter and its interactions
- PS2  Motion and stability: Forces and interactions
- PS3  Energy
- PS4  Waves and their applications in technologies for information transfer

# Disciplinary Core Ideas: Life Sciences

- LS1 From molecules to organisms: Structures and processes
- LS2 Ecosystems: Interactions, energy, and dynamics
- LS3 Heredity: Inheritance and variation of traits
- LS4 Biological evolution: Unity and diversity

# Disciplinary Core Ideas: Earth and Space Sciences

- ESS1 Earth's place in the universe
- ESS2 Earth's systems
- ESS3 Earth and human activity

# Disciplinary Core Ideas: Engineering, Technology and Applications of Science

- ETS1 Engineering design
- ETS2 Links among engineering, technology, science and society

# Integrating the Dimensions

- To facilitate students' learning the dimensions must be woven together in standards, assessments, curriculum and instruction.
- Students should explore a core idea by engaging in the practices and making connections to crosscutting concepts.

# Key Components in the System that Need to be Aligned for Implementation

- Standards
- Curriculum and instructional materials
- Assessment
- Pre-service preparation of teachers
- Professional development for in-service teachers

# Diversity and Equity

- Equalizing opportunities to learn
- Inclusive science instruction
- Making diversity visible
- Value multiple modes of expression

## Guidance for Standards Developers

- Set rigorous learning goals for all students
- Emphasize all 3 dimensions
- Include performance expectations
- Be organized as progressions that support learning over multiple grades
- Attend to issues of diversity and equity

# Key Areas of Research

- Learning progressions
- Scientific and engineering practices
- Curricular and instructional materials
- Assessment
- Supporting teachers' learning
- Evaluation of the impact of standards

# Committee Members

Helen Quinn, Chair Stanford University (Physics)

Wyatt Anderson, University of Georgia (Biology)

Tanya Atwater, UC Santa Barbara (Earth Science)

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Maurice Frazier, Chesapeake Public School System

Free PDF version of *A Framework for K-12 Science Education* is available at: http://www.nap.edu/catalog.php record_id=13165