Nevada State Science Standards
Revision: Why NGSS?

Nevada Next Generation Science Education

Nevada Department of Education
Role of “New” Standards
What they all have in common:

• To update previous content and practices
• To increase depth of knowledge over breadth
• To include cognitive research developed over the past 20 years
• To increase problem solving and critical thinking
• To develop 21st century skills
• To help children become career or college ready
• To show natural connections between content areas
Building on the Past; Preparing for the Future

Phase I

1/2010 - 7/2011

Phase II

7/2010 – Early 2013

1990s

1990s-2009

1990s
Conceptual Shifts in the NGSS

1. K–12 Science Education Should Reflect the Real World Interconnections in Science
2. Using all practices and crosscutting concepts to teach all core ideas all year
3. Science concepts build coherently across K-12
4. The NGSS Focus on Deeper Understanding and Application of Content
5. Integration of science and engineering
6. Coordination with Common Core State Standards
What is new?

1. Central role of scientific and engineering practices

2. Organized around crosscutting concepts & core explanatory ideas

3. Organized in learning progressions
### Framework for K-12 Science Education & Next Generation Science Standards (NGSS)

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Structure of NGSS

- Components
  - Disciplinary Core Ideas
  - Cross Cutting Concepts
  - Science and Engineering Practice

- Connections
  - Content Clarification Statements
  - Assessment Boundaries (performance expectations)
  - Common Core State Standards (ELA & Math)
Disciplinary Core Ideas

- **Earth and Space Sciences**
  - ESS 1: Earth’s place in the universe
  - ESS 2: Earth’s systems
  - ESS 3: Earth and human activity

- **Engineering, Technology and Applications of Sciences**
  - ETS 1: Engineering design
  - ETS 2: Links among engineering, technology, science, and society
Disciplinary Core Ideas

**Life Sciences**
- LS 1: From molecules to organisms: Structures and processes
- LS 2: Ecosystems: Interactions, energy, and dynamics
- LS 3: Heredity: Inheritance and variation of traits
- LS 4: Biological evolution: Unity and diversity

**Physical Sciences**
- PS 1: Matter and its interactions
- PS 2: Motion and stability: Forces and interactions
- PS 3: Energy
- PS 4: Waves and their applications in technologies for information transfer
Crosscutting Concepts

- Patterns
- Cause and effect: Mechanism and explanation
- Scale, proportion, and quantity
- Systems and system models
- Energy and matter: Flows, cycles, and conservation
- Structure and function
- Stability and change
Science and Engineering Practices

1. Asking questions (science) and defining problems (engineering)
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 (science) and designing solutions (engineering)
7. Engaging in argument
8. Obtaining, evaluating, and communicating information
### MS.PS-SPM: Structure and Properties of Matter

**Performance Expectations**

Students who demonstrate understanding can:

- **a. Construct and use models to explain** that atoms combine to form new substances of varying complexity in terms of the number of atoms and repeating subunits. [Clarification Statement: Examples of atoms combining can include Hydrogen (H₂) and Oxygen (O₂) combining to form hydrogen peroxide (H₂O₂) or water (H₂O).] [Assessment Boundary: Valence electrons and bonding energy are not addressed.]

**Science and Engineering Practices**

**Developing and Using Models**

Modeling in 5–8 builds on K–5 and progresses to developing, using, and revising models to explain, explore, and predict more abstract phenomena and design systems.

- Use and/or construct models to predict, explain, and/or collect data to test ideas about phenomena in natural or designed systems, including those representing inputs and outputs. (a)

**Disciplinary Core Ideas**

**PS1.A: Structure and Properties of Matter**

- All substances are made from some 100 different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms. (a)
- Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). (a)

**Crosscutting Concepts**

**Patterns**

Macroscopic patterns are related to the nature of microscopic and atomic-level structure. Patterns in rates of change and other numerical relationships can provide information about natural and human-designed systems. Patterns can be used to identify cause and effect relationships. Graphs and charts can be used to identify patterns in data. (a)

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Language was based on Framework and expanded into Matrices

NRC Framework language from Grade Band Endpoints

Language was based on Framework and expanded into Matrices
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The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education:

Science and Engineering Practices

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Disciplinary Core Ideas

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Crosscutting Concepts

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Connections to other DCIs in this grade level: MS.ESS-ESR, MS.ESS-SS, MS.LS-MEOF
Articulation of DCIs across grade levels: 3-IF, 5-SPM, HS.PS-SPM, HS.PS-NP, HS.PS-E

Common Core State Standards Connections: [Note: these connections will be made more explicit and complete in future draft releases]

ELA—
W.5.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly.
W.6.1 Write arguments to support claims with clear reasons and relevant evidence.
W.7.1 Write arguments to support claims with clear reasons and relevant evidence.
SL.5.4 Report on a topic or text or present an opinion, sequencing ideas logically and using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.
SL.6.4 Present claims and findings, sequencing ideas logically and using pertinent descriptions, facts, and details to accentuate main ideas or themes; use appropriate eye contact, adequate volume, and clear pronunciation.
SL.7.4 Present claims and findings, emphasizing salient points in a focused, coherent manner with pertinent descriptions, facts, details, and examples; use appropriate eye contact, adequate volume, and clear pronunciation.
WHST.6-8.1 Write arguments focused on discipline specific content.
RST.6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

Mathematics—
MP.4 Model with mathematics.
MP.8 Look for and express regularity in repeated reasoning.
S.6SP Develop understanding of statistical variability
Summarize and describe distributions
CCSS ELA, Math and NGSS Practices

Math

M1: Make sense of problems and persevere in solving them
M2: Reason abstractly & quantitatively
M6: Attend to precision
M7: Look for & make use of structure
M8: Look for & make use of regularity in repeated reasoning

M4: Models with mathematics
S2: Develop & use models
S5: Use mathematics & computational thinking

Science

S1: Ask questions and define problems
S3: Plan & carry out investigations
S4: Analyze & interpret data
S6: Construct explanations & design solutions

E2: Build a strong base of knowledge through content rich texts
E5: Read, write, and speak grounded in evidence
M3 & E4: Construct viable arguments and critique reasoning of others
S7: Engage in argument from evidence

E3: Obtain, synthesize, and report findings clearly and effectively in response to task and purpose
S8: Obtain, evaluate, & communicate information

E1: Demonstrate independence in reading complex texts, and writing and speaking about them
E7: Come to understand other perspectives and cultures through reading, listening, and collaborations

Commonalities Among the Practices in Science, Mathematics and English Language Arts

Based on work by Tina Chuek ell.stanford.edu
NVACSS & Nevada Business and Industry

- Equips students with skills that are necessary for all careers—within and beyond STEM fields. Students need the right foundation to tackle long-term and difficult issues that face our generation and future generations.
- Prepares students to enter the workforce with enhanced communication, problem-solving, and critical thinking skills as well as greater resilience—all essential skills for competing and succeeding in today’s workforce.
- Students are required to provide evidence of their own learning, gain skills important for future employment such as communication, collaborate, and engage in inquiry, and systems-thinking.
- Helps students develop a sense of contextual understanding with regard to science knowledge and solutions, helping them to become better informed and well-equipped citizens of the world they will enter.
- Connects scientific principles to real-world situations, allowing for engaging and relevant content and instruction that clearly covers complicated topics.
Recommendations to School Districts Regarding the NVACSS - 2014 based on the NGSS

STOP TEACHING “INQUIRY” WITHOUT CONTENT or “CONTENT” WITHOUT INQUIRY:
Do engage students in using inquiry practices to deepen understanding of core science ideas in current state standards (NVACSS – 2014).

USE CAUTION WHEN MAKING CHANGES TO SCIENCE CONTENT IN THE CURRICULUM:
- Have a transition plan in place (created via districtwide collaboration)
- Purchase instructional materials (textbooks, kits, etc.) that align with the NVACSS

DO INTEGRATE SCIENCE & ENGINEERING PRACTICES AND ENGINEERING CORE IDEAS:
- Get to know the NRC Framework – esp. Chapters 1, 3, 8, 9 and 11;
- View archived NSTA webinars for each Practice; for Engineering; etc. (http://learningcenter.nsta.org/products/web_seminar_archive_sponsor.aspx)
- Redesign lessons so students use the Science and Engineering Practices to develop content understanding.
- Emphasis practices integral to the learning of science for all students.

DO INTEGRATE COMMON CORE LITERACY AND MATHEMATICS STANDARDS:
- Embrace Common Core Science Literacy Standards – they are mirrored in NGSS Practices 7 and 8! (see Common Core ELA pp. 62-66 http://www.corestandards.org)
- Add complex informational text (not just textbooks!)
- Infuse grade-appropriate mathematics into science investigations (NGSS Practice 5)
Performance Expectations

Students who demonstrate understanding can:

- Evaluate data to explain resource availability and other environmental factors that affect carrying capacity of ecosystems.
- Design solutions for creating or maintaining the sustainability of local ecosystems.
- Construct arguments from evidence about the effects of natural biological or physical disturbances in terms of the time needed to reestablish a stable ecosystem and how the new system differs from the original system.
- Use evidence to construct explanations and design solutions for the impact of human activities on the environment and ways to sustain biodiversity and maintain the planet’s natural capital.
- Provide evidence to support explanations of how elements and energy are conserved as they cycle through ecosystems and how organisms compete for matter and energy.
For More Information...

Please visit the following websites for science education resources:

• Nevada Department of Education – Science: [http://www.doe.nv.gov/APAC_Science](http://www.doe.nv.gov/APAC_Science)
• Nevada Next Generation Science Education: [http://www.nevadangse.net](http://www.nevadangse.net)
• Next Generation Science Standards: [www.nextgenscience.org](http://www.nextgenscience.org)