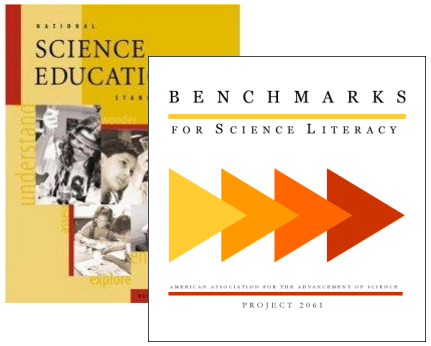
Nevada State Science Standards Revision: Why NGSS?

Role of "New" Standards

What they all have in common:

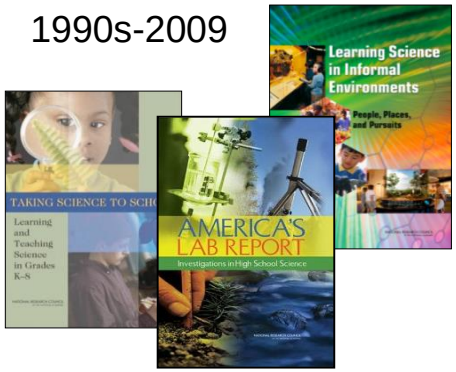
- To update previous content and practices
- To increase depth of knowledge over breadth
- To include cognitive research developed over the past 20 years
- To increase problem solving and critical thinking
- To develop 21st century skills
- To help children become career or college ready
- To show natural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

Building on the Past; Preparing for the Future

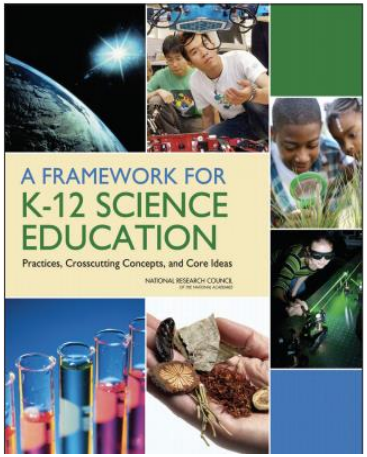


1990s

1990s-2009



Phase I



1/2010 - 7/2011

Phase II

NEXT GENERATION SCIENCE STANDARDS
For States, By States

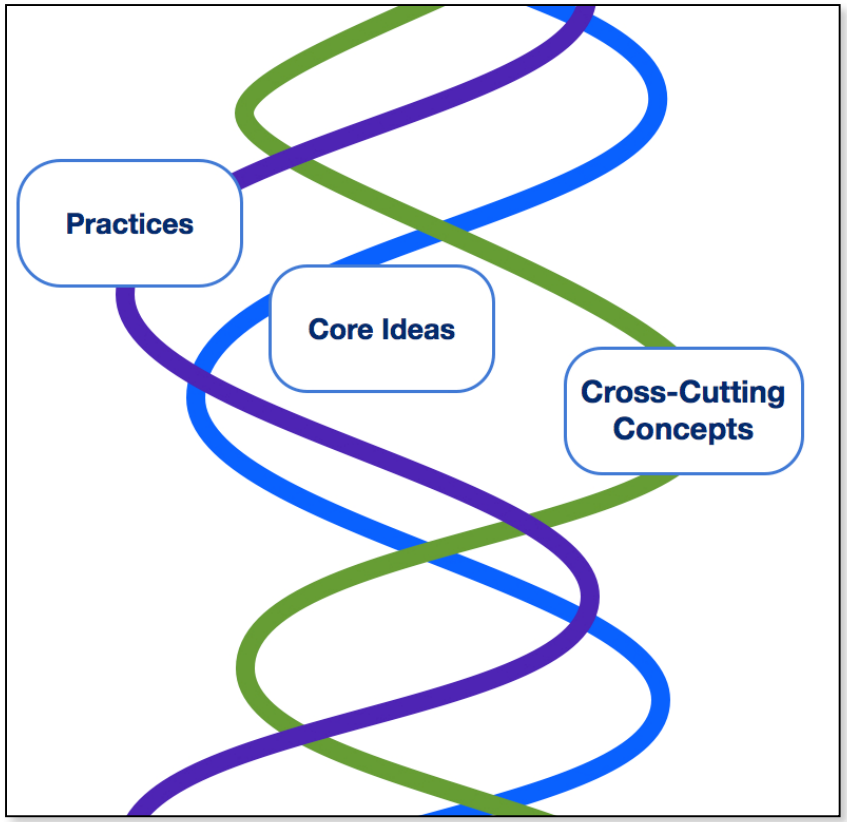
7/2010 – Early 2013

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

NEXT GENERATION SCIENCE STANDARDS
For States, By States

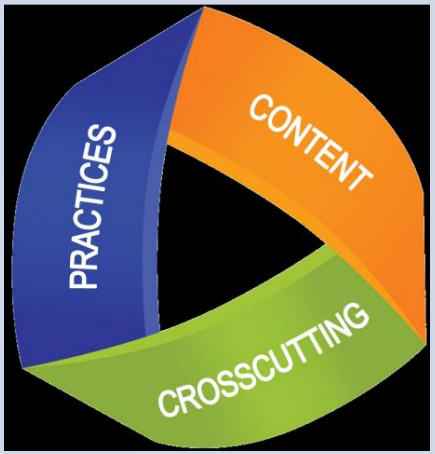
Three Dimensions Intertwined



What is new?

1. Central role of scientific and engineering practices
2. Organized around crosscutting concepts & core explanatory ideas
3. Organized in learning progressions

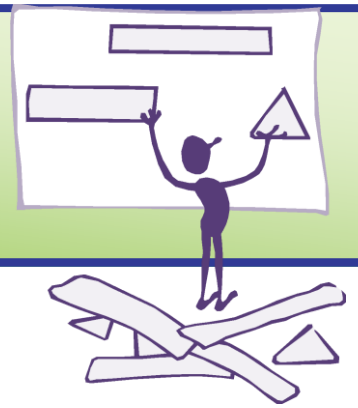
Framework for K-12 Science Education & Next Generation Science Standards (NGSS)

1. Scientific and Engineering Practices ***NSES – Process Skills, Inquiry, and Nature of Science***	2. Crosscutting Concepts **NSES – Unifying Concepts**	3. Disciplinary Core Ideas **NSES Science Content** **Adds Engineering and STEM**
1. Asking questions (for science) and defining problems (for engineering) 2. Developing and using models 3. Planning and carrying out investigations 4. Analyzing and interpreting data 5. Using mathematics and computational thinking 6. Constructing explanations (for science) and designing solutions (for engineering) 7. Engaging in argument from evidence 8. Obtaining, evaluating, and communicating information	1. Patterns 2. Cause and effect: Mechanism and explanation 3. Scale, proportion, and quantity 4. Systems and system models 5. Energy and matter: Flows, cycles, and conservation 6. Structure and function 7. Stability and change ***Utilizes History of Science and Social and personal perspectives***	• **Physical Sciences** • **Life Sciences** • **Earth and Space Sciences** • ***Engineering, Technology, and the Applications of Science*** 

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

NEXT GENERATION SCIENCE STANDARDS

NEVADA STATE ACADEMIC CONTENT STANDARDS FOR SCIENCE
Based on NEXT GENERATION SCIENCE STANDARDS
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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

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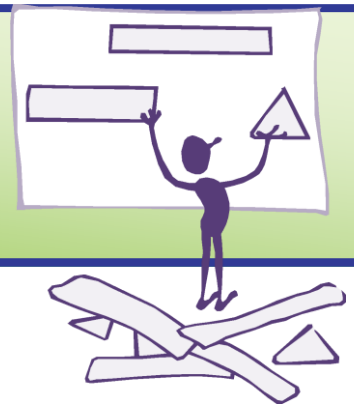
Crosscutting Concepts



- 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

NEXT GENERATION SCIENCE STANDARDS

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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

NEVADA STATE ACADEMIC CONTENT STANDARDS FOR SCIENCE
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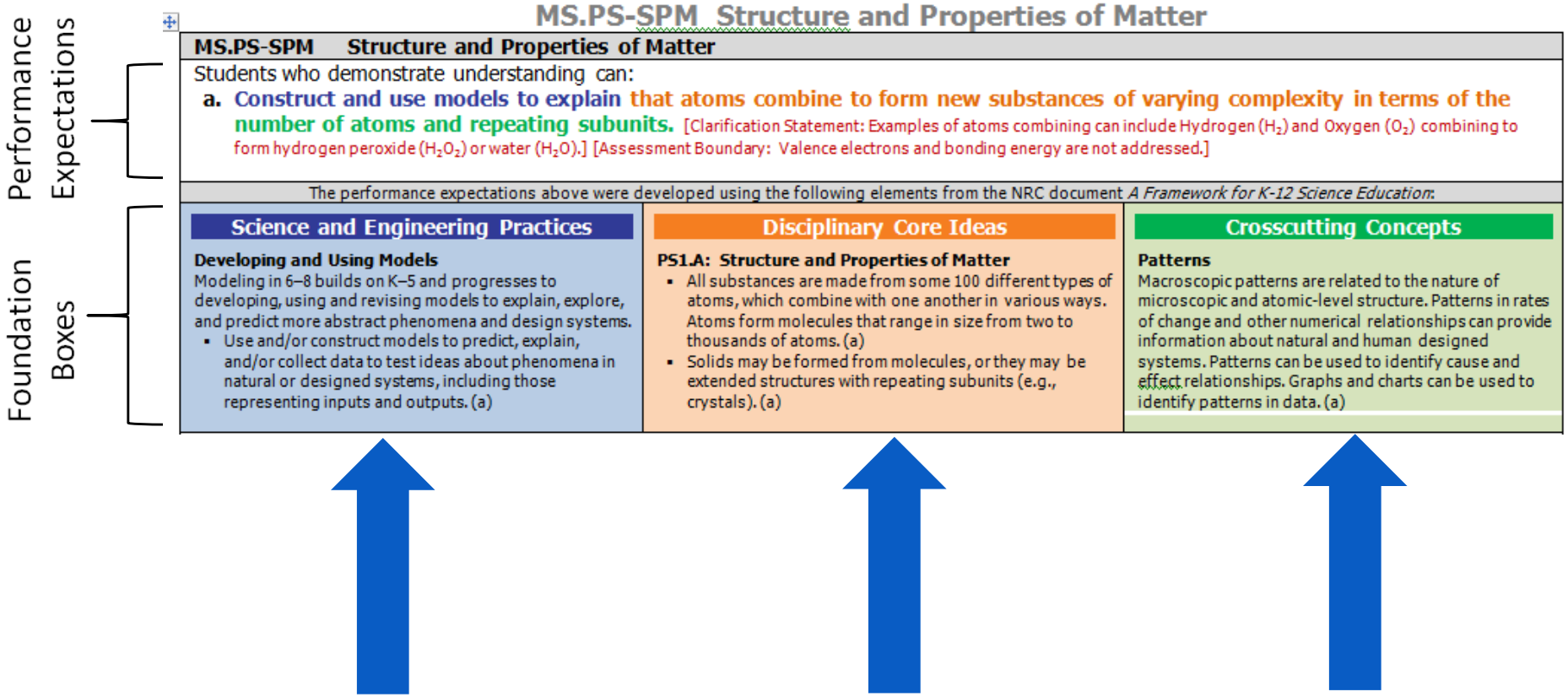

Language was based on Framework and expanded into Matrices

NRC Framework language from Grade Band Endpoints

Language was based on Framework and expanded into Matrices

MS.PS-SPM Structure and Properties of Matter

Performance Expectations

Foundation Boxes

Connection Boxes

MS.PS-SPM Structure and Properties of Matter

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 (H_2) and Oxygen (O_2) combining to form hydrogen peroxide (H_2O_2) or water (H_2O).] [Assessment Boundary: Valence electrons and bonding energy are not addressed.]

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

Developing and Using Models

Modeling in 6–8 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)

Connections to other DCIs in this grade-level: **MS.ESS-ESP, MS.ESS-SS, MS.LS-MEOE**

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.
6.SP	Develop understanding of statistical variability Summarize and describe distributions

NEXT GENERATION SCIENCE STANDARDS
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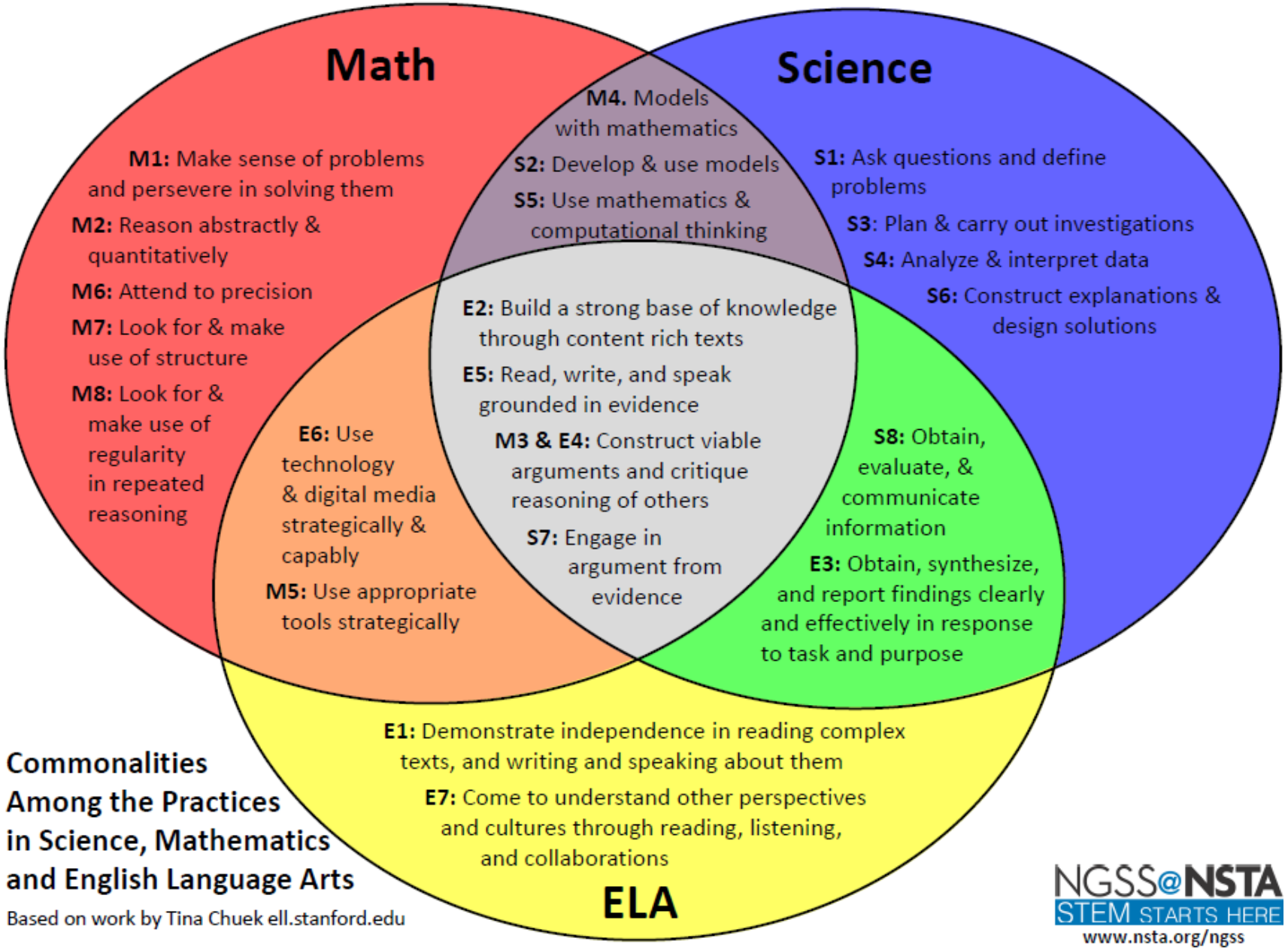
CCSS ELA, Math and NGSS Practices



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

Based on work by Tina Chuek ell.stanford.edu

NGSS@NSTA
STEM STARTS HERE
www.nsta.org/ngss

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.

NEXT GENERATION SCIENCE STANDARDS

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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.**

NEXT GENERATION SCIENCE STANDARDS

For More Information…

Please visit the following websites for science education resources:

- Nevada Department of Education –Science: http://www.doe.nv.gov/APAC_Science
- Nevada Next Generation Science Education: http://www.nevadangse.net
- Next Generation Science Standards: www.nextgenscience.org

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