NEXT GENERATION SCIENCE STANDARDS

Next Generation Science Standards for English Language Learners

Effective Classroom Strategies

Many Districts, Many ELLs

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- Lora Meade, Duval County Public Schools, FL
- Mariel Milano, Orange County Public Schools FL
- Carlos Negron, School District of Lee County, FL
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Three Dimensions

- The Framework for K-12 Science Education contains three dimensions:
  - Dimension I – Scientific and Engineering Practices
  - Dimension II – Crosscutting Concepts
  - Dimension III – Disciplinary Core Ideas

NEXT GENERATION SCIENCE STANDARDS

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

NEXT GENERATION SCIENCE STANDARDS

Classroom Argumentation Prompts

- What assumptions can you make about the observations?
- Does the evidence support your claim? Why or Why Not?
- What evidence did you collect that supports your claim or hypothesis?
- How does _____ affect _____?
- What conclusion can you draw from the evidence?
- What explanation can you propose from the evidence collected?
- How will you defend your findings?
- Does anyone have a response for ____'s claim?

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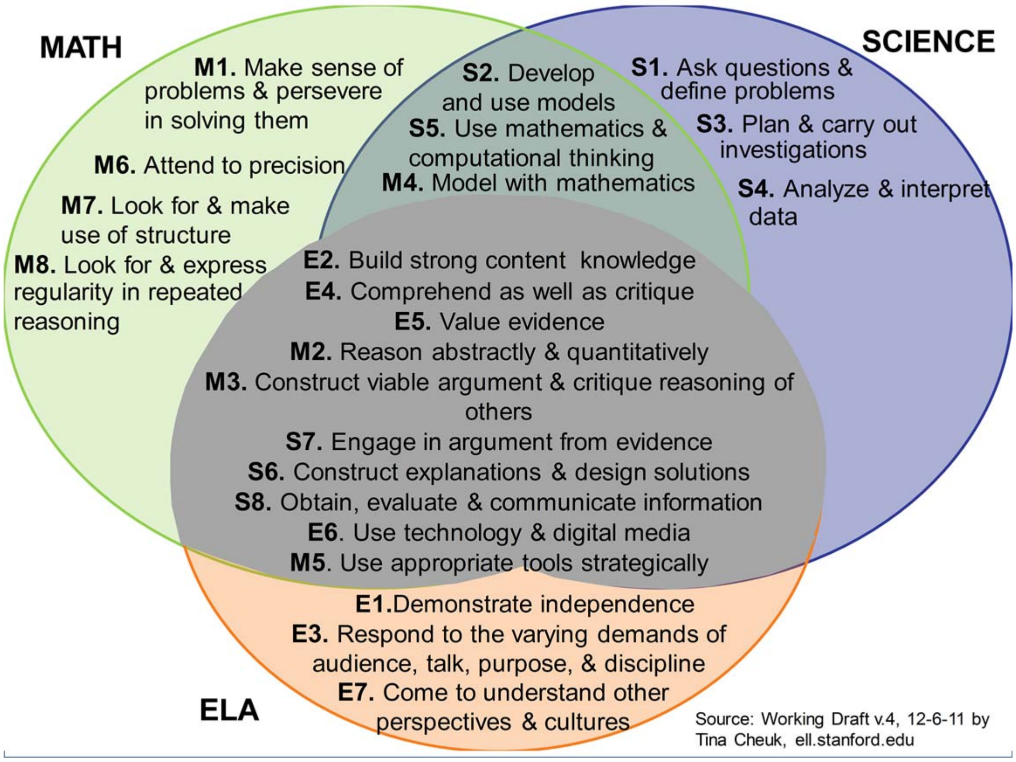
MATH
SCIENCE
M1. Make sense of problems & persevere in solving them
M6. Attend to precision
M7. Look for & make use of structure
M8. Look for & express regularity in repeated reasoning
S2. Develop and use models
S5. Use mathematics & computational thinking
M4. Model with mathematics
S1. Ask questions & define problems
S3. Plan & carry out investigations
S4. Analyze & interpret data
E2. Build strong content knowledge
E4. Comprehend as well as critique
E5. Value evidence
M2. Reason abstractly & quantitatively
M3. Construct viable argument & critique reasoning of others
S7. Engage in argument from evidence
S6. Construct explanations & design solutions
S8. Obtain, evaluate & communicate information
E6. Use technology & digital media
M5. Use appropriate tools strategically
E1.Demonstrate independence
E3. Respond to the varying demands of audience, talk, purpose, & discipline
E7. Come to understand other perspectives & cultures
ELA
Source: Working Draft v.4, 12-6-11 by Tina Cheuk, ell.stanford.edu

NEXT GENERATION
SCIENCE
STANDARDS

What does the *Next Generation of Science* look like for Middle School ELLS?

Science and Engineering Practices
Disciplinary Core Ideas
Crosscutting Concepts

NEXT GENERATION
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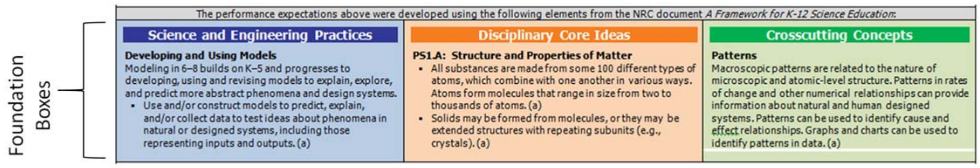
STANDARDS

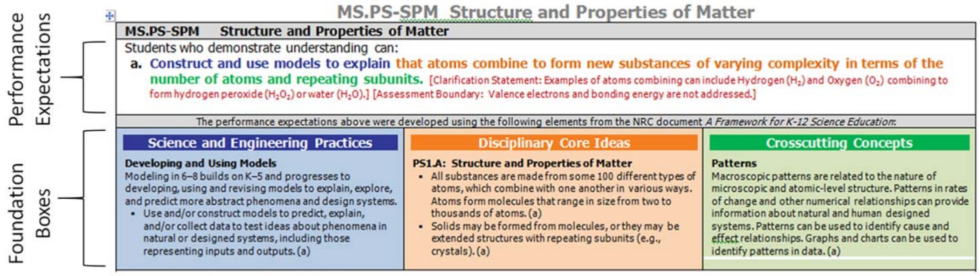


The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:		
Science and Engineering Practices	**Disciplinary Core Ideas**	**Crosscutting Concepts**
Developing and Using Models Modeling in 6–8 builds on K–5 and progresses 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)	**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)	**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)

Performance Expectations

MS.PS-SPM Structure and Properties of Matter

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.]



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Performance Expectations

Foundation Boxes

Connection Boxes

MS.PS-SPM Structure and Properties of Matter

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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

MS.PS-SPM Structure and Properties of Matter

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.]

b. **Plan investigations to generate evidence supporting the claim that one pure substance can be distinguished from another based on characteristic properties.** [Clarification Statement: Properties of substances can include melting and boiling points, density, solubility, reactivity, flammability, and phase.]

c. **Use a simulation or mechanical model to determine the effect on the temperature and motion of atoms and molecules of different substances when thermal energy is added to or removed from the substance.** [Assessment Boundary: Quantification of the model or use of mathematical formulas are not intended.]

d. **Construct an argument that explains the effect of adding or removing thermal energy to a pure substance in different phases and during a phase change in terms of atomic and molecular motion.** [Assessment Boundary: The use of mathematical formulas is not intended.]

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),(c)

Planning and Carrying Out Investigations
Planning and carrying out investigations to answer questions or test solutions to problems in 6–8 builds on K–5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or design solutions.
- Plan and carry out investigations individually and collaboratively, identifying independent and dependent variables, and controls. (b)
- Collect data and generate evidence to answer scientific questions or test design solutions under a range of conditions. (b)

Engaging in Argument from Evidence
Engaging in argument from evidence in 6–8 builds from K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world.
- Use oral and written arguments supported by empirical evidence and reasoning to support or refute an explanation for a phenomenon or a solution to a problem. (d)

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)
- Pure substances are made from a single type of atom or molecule; each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. (b)
- Gases and liquids are made of molecules or inert atoms that are moving about relative to each other. (d)
- In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and may vibrate in position but do not change relative locations. (c),(d)
- Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). (a)
- The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter. (c),(d)

PS3.A: Definitions of Energy
- The term "heat" as used in everyday language refers both to thermal motion (the motion of atoms or molecules within a substance) and radiation (particularly infrared and light). (c),(d)
- Temperature is not a measure of energy; the relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present. (c),(d)

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)

Cause and Effect
Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation. Cause and effect relationships may be used to predict phenomena in natural or designed systems. Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. (c),(d)

Structure and Function
Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the shapes, composition, and relationships among its parts, therefore complex natural and designed structures/systems can be analyzed to determine how they function. Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. (b)

Challenges and Opportunities for ELL Students in the Science and Engineering Practices

- Each table read one practice and discuss opportunities and potential challenges for ELLs in each practice
- Be prepared to share ☺

Implications and Opportunities

If states adopt a common set of science standards, what are the implications for ELLs

- at the district level . . .?
- at the classroom level . . .?

What are language learning opportunities and demands as ELLs engage in scientific and engineering practices of the Next Generation Science Standards?

Impact on Science Instruction for ELLs

NEXT GENERATION SCIENCE STANDARDS

- District Programs
- Professional Development
- Strategies for Language Development

ESOL Population in Miami-Dade County Public Schools

❖Languages Spoken – Spanish, Creole

❖Curriculum – State Standards

❖Textbook – Spanish Version

❖Program Models – Various including ESOL, CCHL, Alternative Language Arts, Project New Beginning

NEXT GENERATION SCIENCE STANDARDS

ESOL Population in Duval County Public Schools

- ❖Languages Spoken – Over 70
- ❖Curriculum – State Standards
- ❖Textbook – English Version
- ❖Program Models – ESOL Centers, Dual Language, Newcomer

NEXT GENERATION SCIENCE STANDARDS

Reasons for Population Differences

- Miami – Relocation from Cuba, Latin America, South America, Haiti
- Jacksonville – Charitable Organizations: Catholic Charities, Lutheran Social Services, World Relief

Newcomer Program in Duval County

- Sheltered Instruction
- Location - Southside Middle & Englewood High School
- Nationalities – 42
- Languages – Over 20
- Grades – 6 through 12

NEXT GENERATION SCIENCE STANDARDS

5 E's Science Instructional Delivery Model

Explore

Explain

Extend/
Elaborate

Engage/
Elicit

Evaluate

NEXT GENERATION SCIENCE STANDARDS

Differentiated Instruction in Science through the 5 E's

Duval County Public Schools
Science Department

Instructional Alignment Chart

Big Idea:_______________

Standard(s) for Grade K	Standard(s) for Grade 1	Standard(s) for Grade 2
SC.K.P.8.1: Sort objects by observable properties, such as size, shape, color, temperature (hot or cold), weight (heavy or light) and texture.	SC.1.P.8.1: Sort objects by observable properties, such as size, shape, color, temperature (hot or cold), weight (heavy or light), texture, and whether objects sink or float.	SC.2.P.8.1: Observe and measure objects in terms of their **properties**, including size, shape, color, temperature, weight, texture, sinking or floating in water, and attraction and repulsion of magnets.

Changes	Changes
From K-1 sink or float has been added. Nothing Deleted	From 1-2 observe and measure has been added. Sinking and floating *in water* and attraction and repulsion of magnets has been added. The words sort and observable have been deleted

Levels of instruction

- Provide Developmental Activities- First time students are introduced to a concept.
- Provide Reinforcement Activities- Second time skills are being taught and skills are being reinforced.
- Provide Drill and Practice Activities- NOT about drill and practice, but about apply the understanding.

Vertical Articulation and Higher Order Questioning

Duval County Public Schools
Science Department

NEXT GENERATION SCIENCE STANDARDS

Academy of Science

"Plug into Science"

NEXT GENERATION SCIENCE
SCHULTZ CENTER
FOR TEACHING & LEADERSHIP

dcps
Duval County Public Schools

ESOL Strategies for Science Learning and Language Development

- Classroom communication
- Input, interaction, and output
- Academic language (content-specific & general)
- Fusing science and language:
  - Differentiated instruction

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Differentiation in Science for ELLs

- Successful language and science integration:
  - whole-group instruction
  - small-group instruction

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Essential Questions Preview

Programs

- 1)What strategies can teachers use to promote science learning for ELLs at varying levels of English proficiency?
- 2)How can teachers support ELLs to develop oral language and literacy skills through science instruction?

PD

- 1)What does teacher professional development in science instruction look like in your district? How does this impact ELLs?
- 2)How can we design and implement effective teacher professional development to improve science achievement of ELLs

Strategies

- 1) What strategies can teachers use to promote science learning for ELLs at varying levels of English proficiency?
- 2) How can teachers support ELLs to develop oral language and literacy skills through science instruction?

Small Group Work

- Based on the number on your notepad, join a facilitator to share best practices and identify key elements for successful science program for ELL students and their teachers
- Group 1- Science Programmatic Elements
- Group 2- Science Professional Development Design
- Group 3- Strategies for Language Development in Science

NEXT GENERATION SCIENCE STANDARDS

What did you learn?

SHARE OUT!

Implications for NGSS and ELL's

NGSS ELL Case Study

We are here to help!

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