TRANSITIONING TO THE NEXT GENERATION SCIENCE STANDARDS

Shelley Nordquist

December 12, 2016

Quick,
Draw a Scientist!

Science Stereotype Pandemic!

- White men
- Glasses
- White hair
- White beards
- Wearing white lab coats

Edutopia February 18, 2016


CAREERS
Employment Opportunities


JOBS

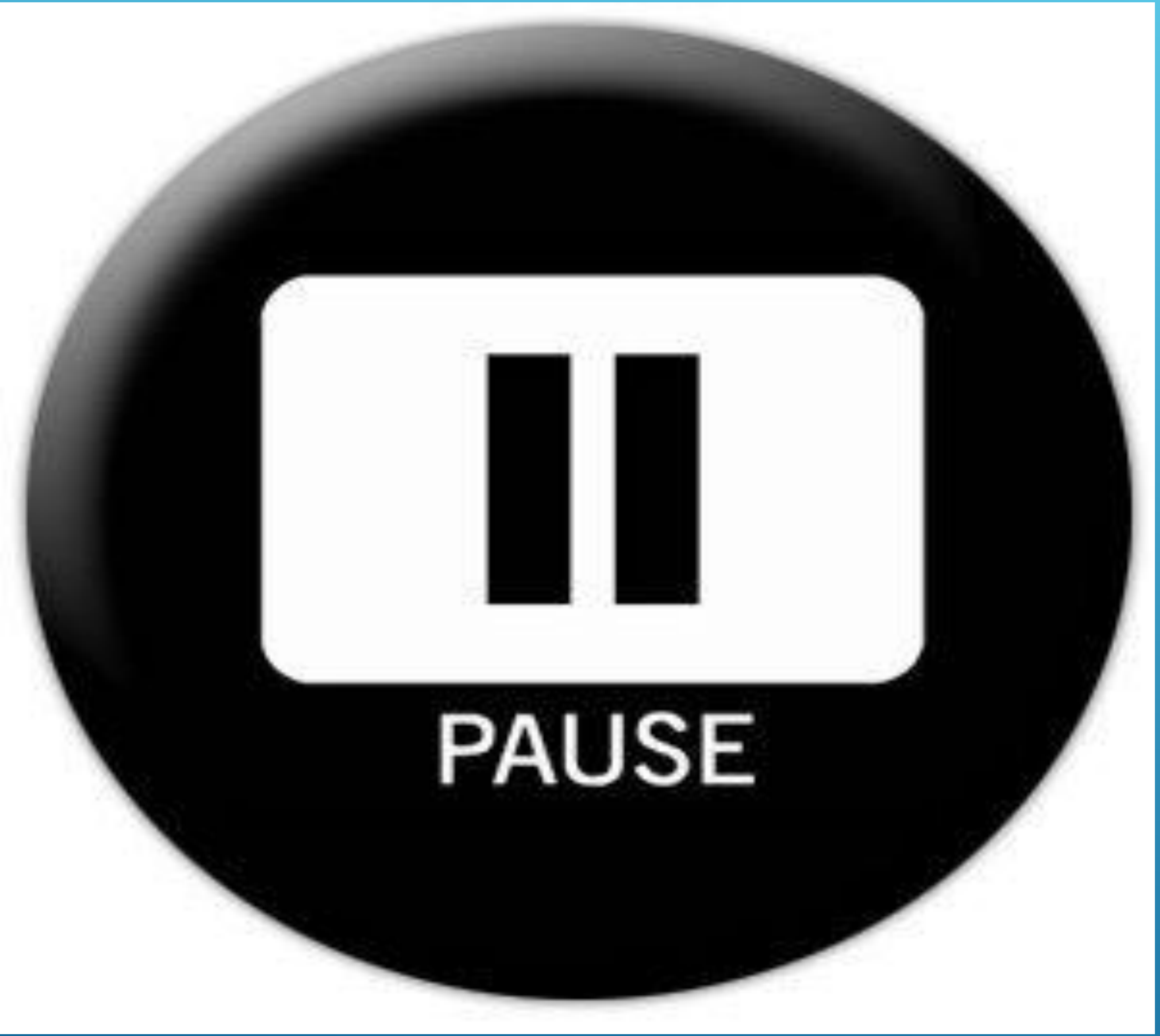
Here Today But About To

- Postal Carriers
- Switchboard Operators
- Data Entry Keyers
- Food Service Managers
- File Clerks
- Planes, Trains, and Automobile Drivers
- Retail
- McJobs
- All Types of Office Work

NAEP STUDY CONCERNS:

In summary, the major findings of this study are that:

- Instructional time for science in the elementary grades has dropped to an average of 2.3 hours per week, the lowest level since 1994;
- Aggregated national and state-level data indicate that less time for science is correlated with lower scores, accounting for approximately 12 points on the 4th grade NAEP Science Scale.
- States with higher average classroom time on science show a pattern of higher NAEP Science scores; additionally, states with higher average classroom time spent on hands-on science activities have higher NAEP scores.



So what does this mean for you as an educator?

CHANGE

NEXT GENERATION
SCIENCE
STANDARDS
For States, By States


What's the
Difference?

Conceptual Shifts

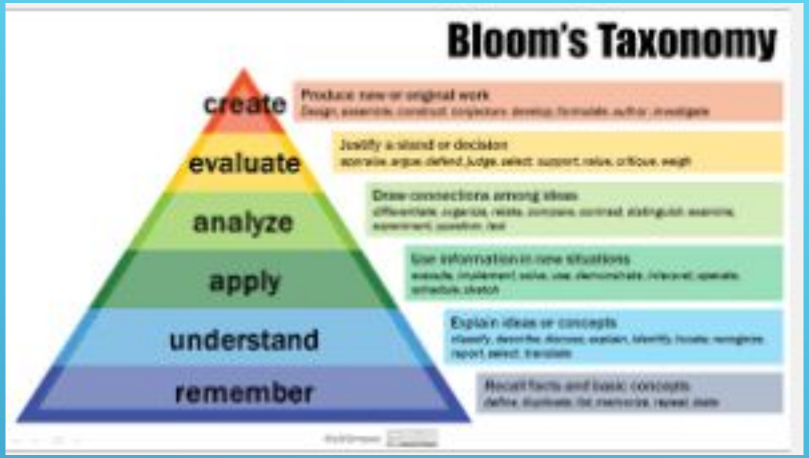
What is New

And

What is Different?

- K-12 Science 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 in the NGSS 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.
- The NGSS are designed to prepare students for college, career, and citizenship.
- The NGSS and Common Core State Standards (English Language Arts and Mathematics) are aligned.

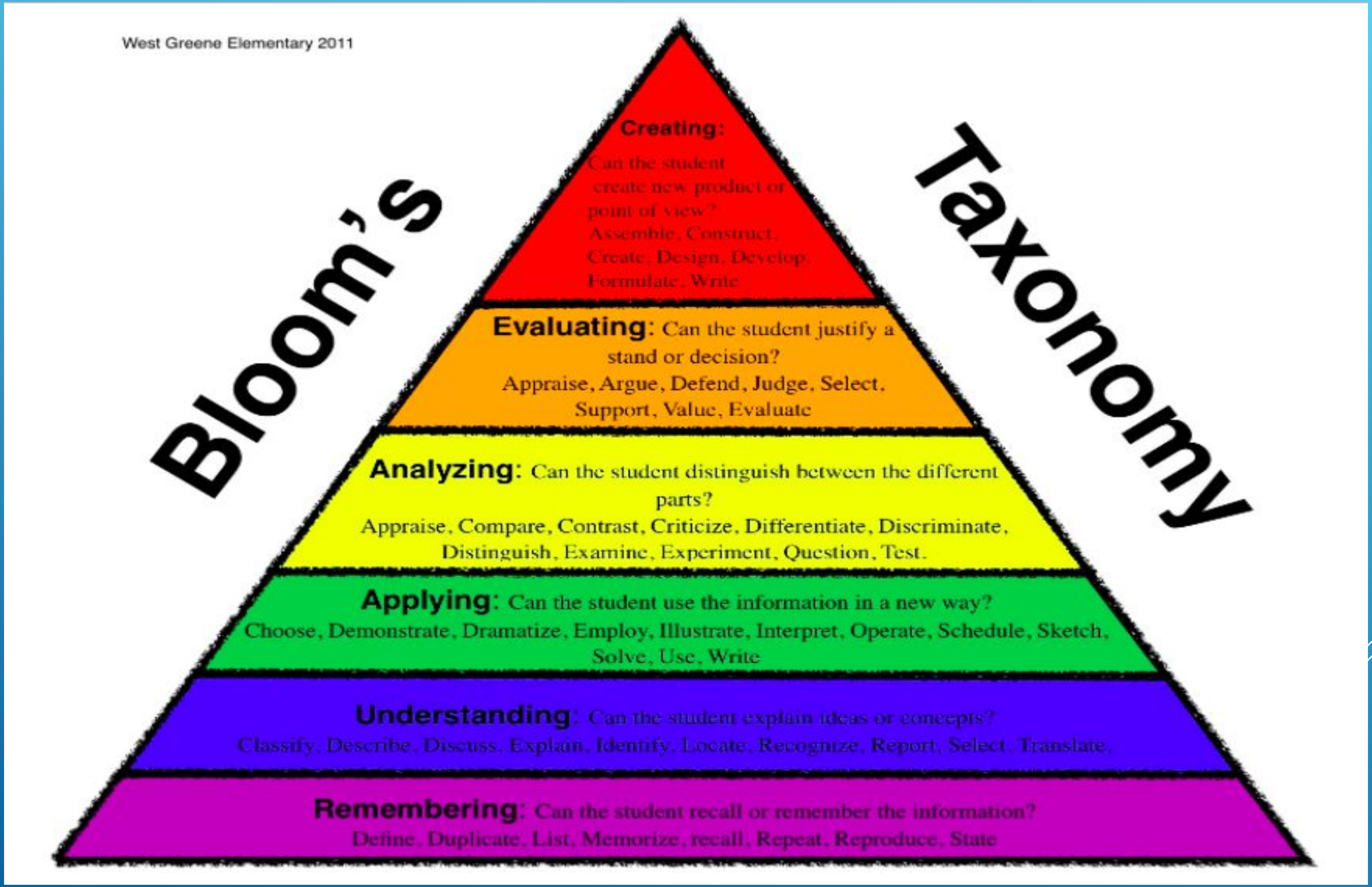
IN THE PAST….



- Structure and Function
- Interaction and Change
- Scientific Inquiry
- Engineering Design

3rd Grade Matter and Energy Standard:

- Compare and contrast the properties of states of matter.

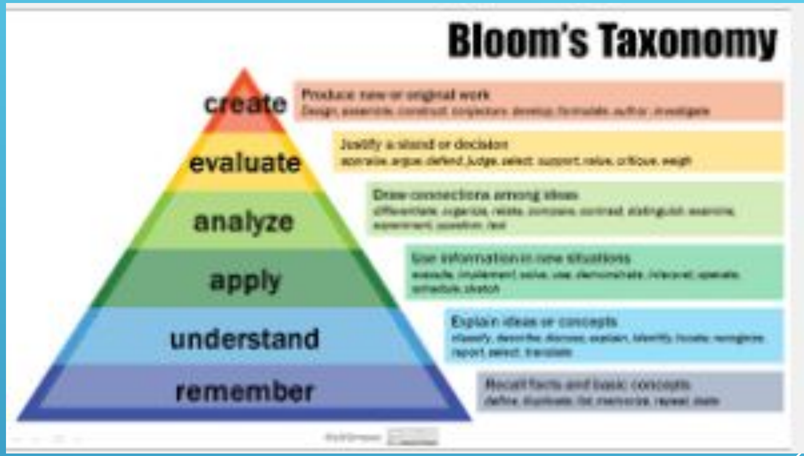

West Greene Elementary 2011
Bloom's
Taxonomy
Creating:
Can the student create new product or point of view?
Assemble, Construct, Create, Design, Develop, Formulate, Write
Evaluating: Can the student justify a stand or decision?
Appraise, Argue, Defend, Judge, Select, Support, Value, Evaluate
Analyzing: Can the student distinguish between the different parts?
Appraise, Compare, Contrast, Criticize, Differentiate, Discriminate, Distinguish, Examine, Experiment, Question, Test.
Applying: Can the student use the information in a new way?
Choose, Demonstrate, Dramatize, Employ, Illustrate, Interpret, Operate, Schedule, Sketch, Solve, Use, Write
Understanding: Can the student explain ideas or concepts?
Classify, Describe, Discuss, Explain, Identify, Locate, Recognize, Report, Select, Translate.
Remembering: Can the student recall or remember the information?
Define, Duplicate, List, Memorize, recall, Repeat, Reproduce, State

WHAT ARE THE NEW SCIENCE STANDARDS?

- K-12 Science Standards
- Identify scientific and engineering practices, crosscutting practices, and core disciplinary ideas that all students should master
- Prepare students for college and 21st – century careers
- Based on new understanding of how students learn science that prepares to succeed in rapidly and constantly changing world
- Provide a strong science education that equips students with the ability to think critically, analyze information, and solve complex problems----the skills needed to pursue opportunities within and beyond STEM fields

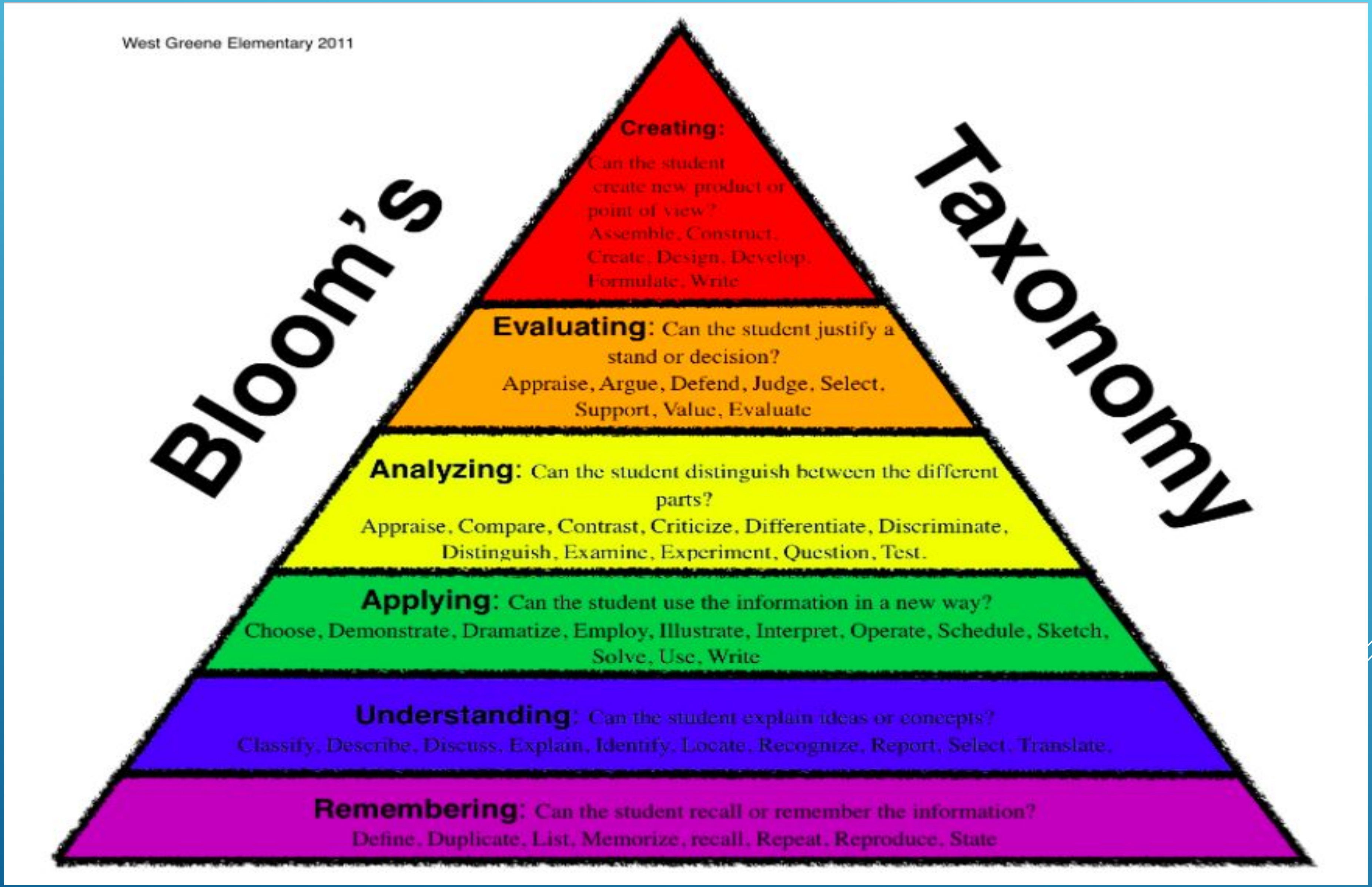
NEXT GENERATION SCIENCE STANDARDS

- **<u>Physical Science</u>** - Matter and Its Interactions, Motion and Stability: Forces and Interactions, Energy, and Waves and their Application in Technologies for Information Transfer.
- **<u>Life Science</u>** – From Molecules to Organisms: Structures and Processes, Ecosystems: Interactions, Energy, and Dynamics, Heredity: Inheritance and Variation of Traits, Biological Evolution: Unity and Diversity
- **<u>Earth and Space Sciences</u>** – Earth's Place in the Universe, Earth's Systems, Earth and Human Activity
- **<u>Engineering Design</u>**



- 2nd Grade Matter and Its Interactions

Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties. [Clarification Statement: Observations could include color, texture, hardness, and flexibility. Patterns could include the similar properties that different materials share.]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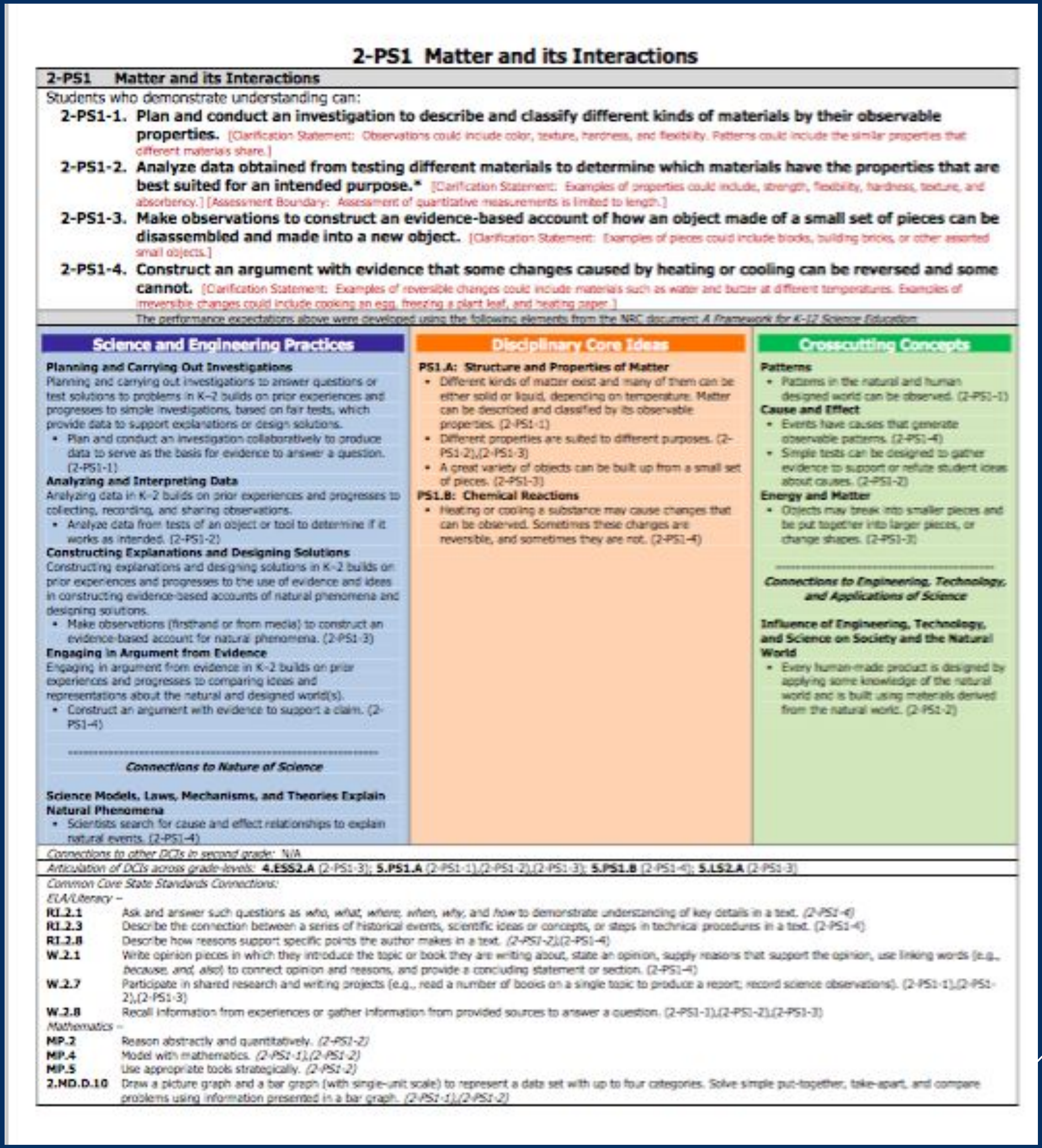
Why NGSS Now?

Taking a closer look at the standard document….

Standards and Clarification

CCSS connection



2-PS1 Matter and its Interactions

2-PS1 Matter and its Interactions

Students who demonstrate understanding can:

2-PS1-1. Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties. [Clarification Statement: Observations could include color, texture, hardness, and flexibility. Patterns could include the similar properties that different materials share.]

2-PS1-2. Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.* [Clarification Statement: Examples of properties could include, strength, flexibility, hardness, texture, and absorbency.] [Assessment Boundary: Assessment of quantitative measurements is limited to length.]

2-PS1-3. Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object. [Clarification Statement: Examples of pieces could include blocks, building bricks, or other assorted small objects.]

2-PS1-4. Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot. [Clarification Statement: Examples of reversible changes could include materials such as water and butter at different temperatures. Examples of irreversible changes could include cooking an egg, freezing a plant leaf, and heating paper.]

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

Planning and Carrying Out Investigations
Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.
- Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question. (2-PS1-1)

Analyzing and Interpreting Data
Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations.
- Analyze data from tests of an object or tool to determine if it works as intended. (2-PS1-2)

Constructing Explanations and Designing Solutions
Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions.
- Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena. (2-PS1-3)

Engaging in Argument from Evidence
Engaging in argument from evidence in K–2 builds on prior experiences and progresses to comparing ideas and representations about the natural and designed world(s).
- Construct an argument with evidence to support a claim. (2-PS1-4)

Connections to Nature of Science

Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena
- Scientists search for cause and effect relationships to explain natural events. (2-PS1-4)

Disciplinary Core Ideas

PS1.A: Structure and Properties of Matter
- Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature. Matter can be described and classified by its observable properties. (2-PS1-1)
- Different properties are suited to different purposes. (2-PS1-2),(2-PS1-3)
- A great variety of objects can be built up from a small set of pieces. (2-PS1-3)

PS1.B: Chemical Reactions
- Heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible, and sometimes they are not. (2-PS1-4)

Crosscutting Concepts

Patterns
- Patterns in the natural and human designed world can be observed. (2-PS1-1)

Cause and Effect
- Events have causes that generate observable patterns. (2-PS1-4)
- Simple tests can be designed to gather evidence to support or refute student ideas about causes. (2-PS1-2)

Energy and Matter
- Objects may break into smaller pieces and be put together into larger pieces, or change shapes. (2-PS1-3)

Connections to Engineering, Technology, and Applications of Science

Influence of Engineering, Technology, and Science on Society and the Natural World
- Every human-made product is designed by applying some knowledge of the natural world and is built using materials derived from the natural world. (2-PS1-2)

Connections to other DCIs in second grade: N/A

Articulation of DCIs across grade-levels: **4.ESS2.A** (2-PS1-3); **5.PS1.A** (2-PS1-1),(2-PS1-2),(2-PS1-3); **5.PS1.B** (2-PS1-4); **5.LS2.A** (2-PS1-3)

Common Core State Standards Connections:

ELA/Literacy –

RI.2.1 Ask and answer such questions as *who, what, where, when, why,* and *how* to demonstrate understanding of key details in a text. *(2-PS1-4)*

RI.2.3 Describe the connection between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text. (2-PS1-4)

RI.2.8 Describe how reasons support specific points the author makes in a text. *(2-PS1-2),(2-PS1-4)*

W.2.1 Write opinion pieces in which they introduce the topic or book they are writing about, state an opinion, supply reasons that support the opinion, use linking words (e.g., *because, and, also*) to connect opinion and reasons, and provide a concluding statement or section. (2-PS1-4)

W.2.7 Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations). (2-PS1-1),(2-PS1-2),(2-PS1-3)

W.2.8 Recall information from experiences or gather information from provided sources to answer a question. (2-PS1-1),(2-PS1-2),(2-PS1-3)

Mathematics –

MP.2 Reason abstractly and quantitatively. *(2-PS1-2)*

MP.4 Model with mathematics. *(2-PS1-1),(2-PS1-2)*

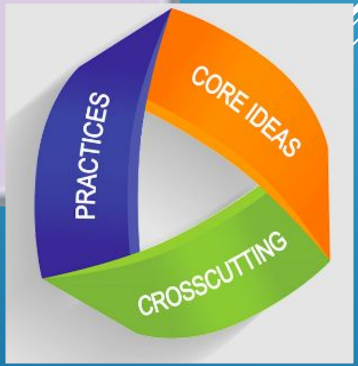
MP.5 Use appropriate tools strategically. *(2-PS1-2)*

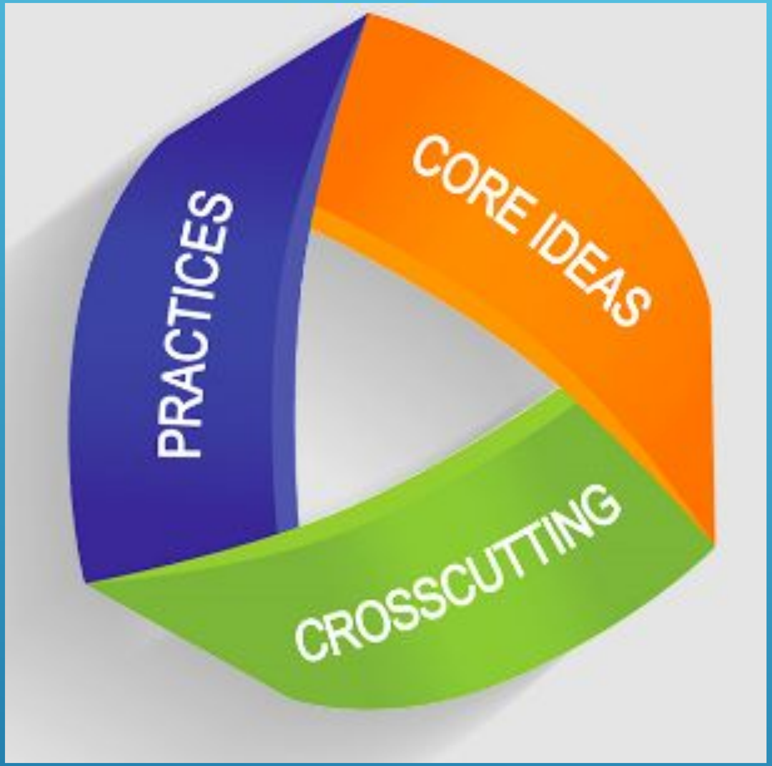
2.MD.D.10 Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems using information presented in a bar graph. *(2-PS1-1),(2-PS1-2)*

- Eight Practices
  - Asking questions and defining problems
  - Developing and using models
  - Planning and carrying out investigations
  - Analyzing and interpreting data
  - Using mathematics and computational thinking
  - Constructing Explanations and Designing Solutions
  - Engaging in argument from evidence
  - Obtaining, evaluating, and communicating information

- Seven Crosscutting Concepts
  - Patterns
  - Cause and effect
  - Scale, proportion, and quantity
  - Systems and system models
  - Energy and matter: Flows, cycles, and conservation
  - Structure and function
  - Stability and change

- Four Disciplinary Core Ideas:
  - ✓ Life Science,
  - ✓ Physical Science
  - ✓ Earth and Space Science
  - ✓ Engineering

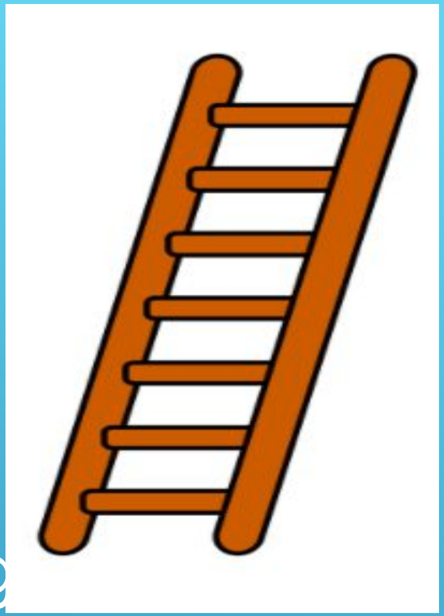




Practices are the processes of using Core Ideas to make sense of the natural and designed world, and Crosscutting Concepts hold the disciplines together.

THE THREE DIMENSIONS OF SCIENCE LEARNING

Vertical Alignment



- Appendix E – Disciplinary Core Ideas Progressions
- Appendix F – Science and Engineering Practices Prog
- Appendix G – Crosscutting Concepts Progressions

Criterion 3 & 4: COHERENCE
Learning experiences form a coherent learning progression in which each K-5 student builds competencies in the performance expectations through actively engaging in science and engineering practices and applying crosscutting concepts to continually build on and revise their knowledge and skills in disciplinary core ideas.

NEXT GENERATION SCIENCE STANDARDS
For States, By States

Physical Science Progression

INCREASING SOPHISTICATION OF STUDENT THINKING

	K-2	3-5	6-8	9-12
PS1.A Structure of matter (includes PS1.C Nuclear processes)	Matter exists as different substances that have observable different properties. Different properties are suited to different purposes. Objects can be built up from smaller parts.	Because matter exists as particles that are too small to see, matter is always conserved even if it seems to disappear. Measurements of a variety of observable properties can be used to identify particular materials.	The fact that matter is composed of atoms and molecules can be used to explain the properties of substances, diversity of materials, states of matter, phase changes, and conservation of matter.	The sub-atomic structural model and interactions between electric charges at the atomic scale can be used to explain the structure and interactions of matter, including chemical reactions and nuclear processes. Repeating patterns of the periodic table reflect patterns of outer electrons. A stable molecule has less energy than the same set of atoms separated; one must provide at least this energy to take the molecule apart.

Disciplinary Core Idea Progression

Science and Engineering Practices Progressions
Developing and Using Models

Grades K-2	Grades 3-5	Grades 6-8	Grades 9-12
Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions. • Distinguish between a model and the actual object, process, and/or events the model represents. • Compare models to identify common features and differences. • Develop and/or use a model to represent amounts, relationships, relative scales (bigger, smaller), and/or patterns in the natural and designed world(s). • Develop a simple model based on evidence to represent a proposed object or tool.	Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions. • Identify limitations of models. • Collaboratively develop and/or revise a model based on evidence that shows the relationships among variables for frequent and regular occurring events. • Develop a model using an analogy, example, or abstract representation to describe a scientific principle or design solution. • Develop and/or use models to describe and/or predict phenomena. • Develop a diagram or simple physical prototype to convey a proposed object, tool, or process. • Use a model to test cause and effect relationships or interactions concerning the functioning of a natural or designed system.	Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems. • Evaluate limitations of a model for a proposed object or tool. • Develop or modify a model— based on evidence – to match what happens if a variable or component of a system is changed. • Use and/or develop a model of simple systems with uncertain and less predictable factors. • Develop and/or revise a model to show the relationships among variables, including those that are not observable but predict observable phenomena. • Develop and/or use a model to predict and/or describe phenomena. • Develop a model to describe unobservable mechanisms. • Develop and/or use a model to generate data to test ideas about phenomena in natural or designed systems, including those representing inputs and outputs, and those at unobservable scales.	Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds. • Evaluate merits and limitations of two different models of the same proposed tool, process, mechanism or system in order to select or revise a model that best fits the evidence or design criteria. • Design a test of a model to ascertain its reliability. • Develop, revise, and/or use a model based on evidence to illustrate and/or predict the relationships between systems or between components of a system. • Develop and/or use multiple types of models to provide mechanistic accounts and/or predict phenomena, and move flexibly between model types based on merits and limitations. • Develop a complex model that allows for manipulation and testing of a proposed process or system. • Develop and/or use a model (including mathematical and computational) to generate data to support explanations, predict phenomena, analyze systems, and/or solve problems.

Progression Across the Grades	Performance Expectation from the NGSS
In grades K-2, students observe objects may break into smaller pieces, be put together into larger pieces, or change shapes.	2-PS1-3. Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object.
In grades 3-5, students learn matter is made of particles and energy can be transferred in various ways and between objects. Students observe the conservation of matter by tracking matter flows and cycles before and after processes and recognizing the total weight of substances does not change.	5-LS1-1. Support an argument that plants get the materials they need for growth chiefly from air and water.
In grades 6-8, students learn matter is conserved because atoms are conserved in physical and chemical processes. They also learn within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter. Energy may take different forms (e.g. energy in fields, thermal energy, energy of motion). The transfer of energy can be tracked as energy flows through a designed or natural system.	MS-ESS2-4. Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.
In grades 9-12, students learn that the total amount of energy and matter in closed systems is conserved. They can describe changes of energy and matter in a system in terms of energy and matter flows into, out of, and within that system. They also learn that energy cannot be created or destroyed. It only moves between one place and another place, between objects and/or fields, or between systems. Energy drives the cycling of matter within and between systems. In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved.	HS-PS1-8. Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.

Crosscutting Concepts Progressions
Energy and Matter

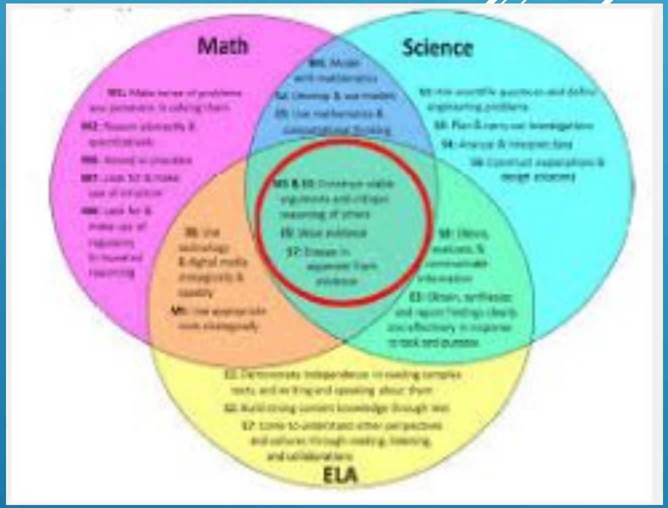
What did your science classroom look like?

NGSS CALLS FOR CHANGE in CLASSROOMS…

- Hands-on collaborative integrated environment rooted in inquiry and discovery
- Student-centered learning that enables students to think on their own, problem solve, communicate, and collaborate
- Learn important scientific concepts

FIVE INNOVATIONS FOR TEACHING

- Three Dimensional Learning
- All three dimensions build coherent learning progressions
- Students engage with phenomena and design solutions
- Engineering and the Nature of Science is integrated into science
- Science is connected to math and literacy



How Do We Implement the NGSS?

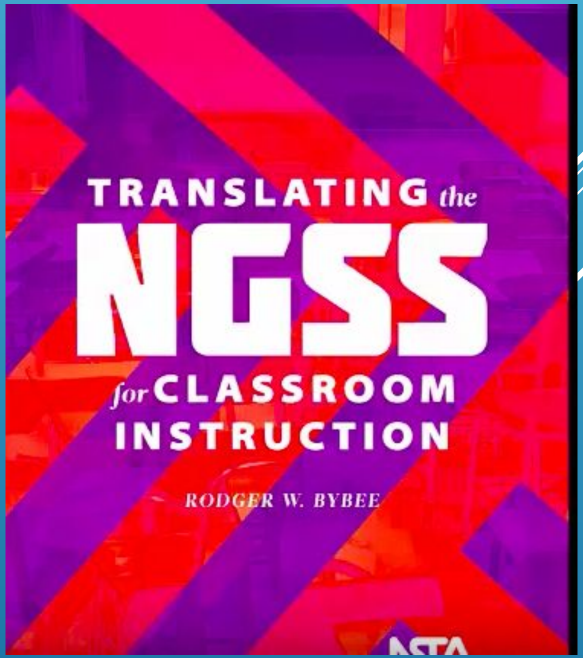
"For the first challenge, taking a standard from the *NGSS* was more complicated than thinking of a lesson that aligned with a standard because the standard included several performance expectations that formed the basis for assessments, curriculum, and instruction. The task was not as simple as finding a lesson for each performance expectation. I had to approach the problem of translating the standards into classroom instruction with a perspective broader than a single lesson or hands-on activity."

Rodger Bybee

Translating the NGSS for Classroom Instruction

8. Instructional sequence consistently provides multiple opportunities and adequate time for student learning.

Next Generation Science Standards: Appendix A and Appendix E



CHOOSING A RESOURCE THAT PROVIDES MULTIPLE OPPORTUNITIES OF SUPPORT

Learning Targets

Define matter.

Description: Lesson 1 - Properties of Matter - Engage
Lesson 1 - Properties of Matter - Explore
Lesson 1 - Properties of Matter - Explain

SEP Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.
Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question.
SEP Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations. Analyze data from tests of an object or tool to determine if it works as intended.
XCC Simple tests can be designed to gather evidence to support or refute student ideas about causes.
XCC Patterns in the natural and human designed world can be observed.
Connections to Engineering, Technology, and Application of Science Every human-made product is designed by applying some knowledge of the natural world and is built using materials derived from the natural world.

Describe properties of a solid and a liquid.

Description: Lesson 1 - Properties of Matter - Explore
Lesson 1 - Properties of Matter - Explain
Lesson 1 - Properties of Matter - Elaborate
Lesson 1 - Properties of Matter - Evaluate

Lesson 2 - Properties of Matter - Engage
Lesson 2 - Properties of Matter - Explore
Lesson 2 - Properties of Matter - Explain
Lesson 2 - Properties of Matter - Elaborate
Lesson 2 - Properties of Matter - Evaluate

Lesson 3 - Properties of Matter - Engage
Lesson 3 - Properties of Matter - Explore
Lesson 3 - Properties of Matter - Explain

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Types of Resource Support We Discovered

Literacy-Based Programs

Traditional Science in Transition

Old Copyrights

STEM

OREGON INSTRUCTIONAL MATERIALS EVALUATION TOOLKIT (OR-IMET)

1. FOCUS – limited number of DCI's, students engage with meaningful phenomena or problems that can be explained or solved through the application of SEP's and CCC's.
2. RIGOR – instructional materials should support robust, culturally responsive instruction for each of the three dimensions to allow for conceptual understanding, procedural skills and application of the NGSS.
3. COHERENCE – instructional materials should provide strong links and progressions among the three dimensions of the NGSS between each unit, grade level, and grade span for a unified learning experience.

Let’s dive a little deeper!

A term we have not explored…phenomena!

Every lesson should have phenomena:

- Science often begins when someone makes an observation about a situation or an occurrence.
- Spark your students' curiosity about the world around them!
- Keep students "figuring out" rather than "learning about".

1d. In each K-5 grade level, in student and educator materials, when used as designed the three-dimensions work together to support students to make sense of phenomena and/or to design solutions to problems.

Integrating the Three Dimensions in the Framework for K12 Science Education (NRC 2012) (pp. 220-240 for examples of how this can be done) and Appendix A.

1A, !B, 1C, 1D

4. Materials are directly connected to the appropriate grade-level performance expectations to develop and use specific engineering practices, disciplinary core ideas, and crosscutting concepts that are integrated to develop and support students' sense-making of phenomena and/or design solutions to problems.

Changing Forces

http://www.ngssphenomena.com/

5E LESSON PLANS

- Engage
- Explore
- Explain (vocabulary instruction happens here)
- Elaborate
- Evaluate

Not necessarily linear, sometimes you have to move students back to explore for additional understanding.

https://www.youtube.com/watch?v=G4J4Am8vLrY

Criterion 2: RIGOR

Materials support and guide in-depth instruction in the three intertwined NGSS dimensions*, support the integration of conceptual understanding linked to explanations and empirical investigations that allow students to evaluate knowledge claims and develop procedural skills while engaging in authentic and content-appropriate scientific inquiry and engineering design learning experiences, and provide opportunities for students to engage in practice, discourse, and reflection in multiple interconnected and social contexts.

Criterion 5, 8 & 9: COHERENCE
Instructional sequence provides multiple approaches to achieve proficiency of the performance expectations and a logical progression of diverse instructional strategies for student learning.

5, 9B

Table 1. Summary of the BSCS 5E Instructional Model

Phase	Summary
Engagement	The teacher or a curriculum task accesses the learners' prior knowledge and helps them become engaged in a new concept through the use of short activities that promote curiosity and elicit prior knowledge. The activity should make connections between past and present learning experiences, expose prior conceptions, and organize students' thinking toward the learning outcomes of current activities.
Exploration	Exploration experiences provide students with a common base of activities within which current concepts (i.e., misconceptions), processes, and skills are identified and conceptual change is facilitated. Learners may complete lab activities that help them use prior knowledge to generate new ideas, explore questions and possibilities, and design and conduct a preliminary investigation.
Explanation	The explanation phase focuses students' attention on a particular aspect of their engagement and exploration experiences and provides opportunities to demonstrate their conceptual understanding, process skills, or behaviors. This phase also provides opportunities for teachers to directly introduce a concept, process, or skill. Learners explain their understanding of the concept. An explanation from the teacher or the curriculum may guide them toward a deeper understanding, which is a critical part of this phase.
Elaboration	Teachers challenge and extend students' conceptual understanding and skills. Through new experiences, the students develop deeper and broader understanding, more information, and adequate skills. Students apply their understanding of the concept by conducting additional activities.
Evaluation	The evaluation phase encourages students to assess their understanding and abilities and provides opportunities for teachers to evaluate student progress toward achieving the educational objectives.

ALL 5E LESSON INCLUDE:

- Three-Dimensional Learning embedded within lessons
- ELL Support
- Differentiation for Struggling Learners
- Connection to English Language Arts and Math

Criterion 3 & 10: Coherence
Materials support and guide in-depth instruction in the three intertwined NGSS dimensions, with clear connections to the Common Core State Standards (CCSS) in Mathematics and English Language Arts & Literacy and the Oregon English Language Proficiency Standards.

9a. Materials use diverse instructional strategies that provide clear purposes for learning experiences (e.g., elicit preconceptions, teach new knowledge, build skills and abilities, and connects to prior knowledge).

Next Generation Science Standards: Appendix A and Appendix D (pp.10-17)

Criterion 6 & 7: COHERENCE
The interdependence and the influence of science, engineering and technology on society and the natural world along with the understanding of the nature of science are interconnected to the content being addressed.

OTHER HELPFUL APPENDICES

- NATURE OF SCIENCE – APPENDIX H

Science is the pursuit of explanations of the natural world, and technology and engineering are means of accommodating human needs, intellectual curiosity and aspirations.

- SCIENCE TECHNOLOGY, SOCIETY AND THE ENVIRONMENT – APPENDIX J

Scientific discoveries and technological decisions affect human society and the natural environment. People make decisions for social and environmental reasons that ultimately guide the work of scientists and engineers.

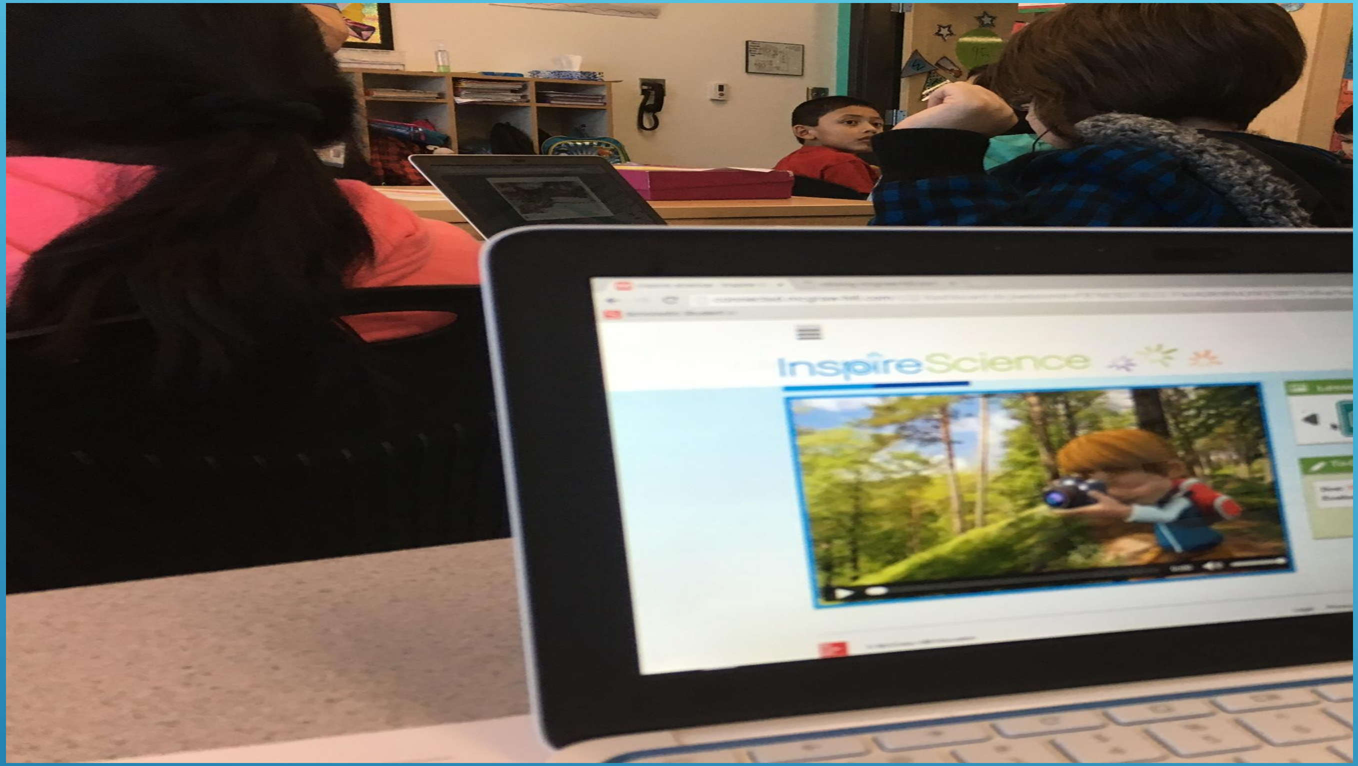
- Pre-Assessment
- Formative Assessments
- Rubrics
- Performance Assessments

Assessment Options

Observable features of the student performance by the end of the grade:			
1	Identifying the phenomenon under investigation		
	a	Students identify and describe the phenomenon under investigation, which includes the following idea: different kinds of matter have different properties, and sometimes the same kind of matter has different properties depending on temperature.	
	b	Students identify and describe the purpose of the investigation, which includes answering a question about the phenomenon under investigation by describing and classifying different kinds of materials by their observable properties.	
2	Identifying the evidence to address the purpose of the investigation		
	a	Students collaboratively develop an investigation plan and describe the evidence that will be collected, including the properties of matter (e.g., color, texture, hardness, flexibility, whether is it a solid or a liquid) of the materials that would allow for classification, and the temperature at which those properties are observed.	
	b	Students individually describe that:	
		i.	The observations of the materials provide evidence about the properties of different kinds of materials.
		ii.	Observable patterns in the properties of materials provide evidence to classify the different kinds of materials.
3	Planning the investigation		
	a	In the collaboratively developed investigation plan, students include:	
		i.	Which materials will be described and classified (e.g., different kinds of metals, rocks, wood, soil, powders).
		ii.	Which materials will be observed at different temperatures, and how those temperatures will be determined (e.g., using ice to cool and a lamp to warm) and measured (e.g., qualitatively or quantitatively).
		iii.	How the properties of the materials will be determined.
		iv.	How the materials will be classified (i.e., sorted) by the pattern of the properties.
	b	Students individually describe how the properties of materials, and the method for classifying them, are relevant to answering the question.	
4	Collecting the data		
	a	According to the developed investigation plan, students collaboratively collect and record data on the properties of the materials.	

CAN WE CHANGE THE PERCEPTION OF WHO CAN BE A SCIENTIST?

Helps students to imagine themselves and aspire to be in STEM careers!



Balance of Digital and Non-Digital Resources

- Reflection, Take Aways, & Questions

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