NEW LOUISIANA SCIENCE STANDARDS

Louisiana Science Teachers Association

June 8, 2017

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Louisiana Science Teachers Association

BEFORE YOU LEAVE TODAY…

- You should be able to:
  - Explain the parts of the standards
  - Talk the Talk
  - Understand this is a process and will require change
  - Inform your district leaders of possible next steps
  - Expand your network of colleagues

- You will still need to:
  - Continue the process of understanding the standard and the 3 dimensions
  - Determine changes that will be required in your curriculum and instruction
  - Communicate to district leaders the significance of the shifts and the developmental steps of implementation

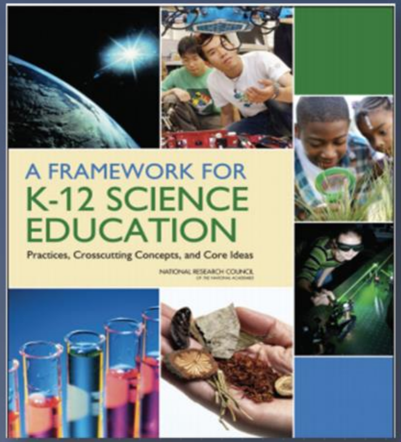
WHAT HAS CHANGED?

TIMELINE ACTIVITY

WHAT HAS NOT CHANGED?

BACKGROUND

- Current benchmarks were adopted in May 1997.
- GLE's were written in 2004.
- The comprehensive curriculum for science was last updated in 2008 under Paul Pastorek.
- _A Framework for K-12 Science Education_ published in 2012.
- NGSS (Next Generation Science Standards) were released in 2013.
- BESE approved the adoption of new Louisiana Student Standards for Science, March 8, 2017.



WHERE CAN I FIND THE NEW SCIENCE STANDARDS?

- http://www.louisianabelieves.com/resources/library/academic-standards

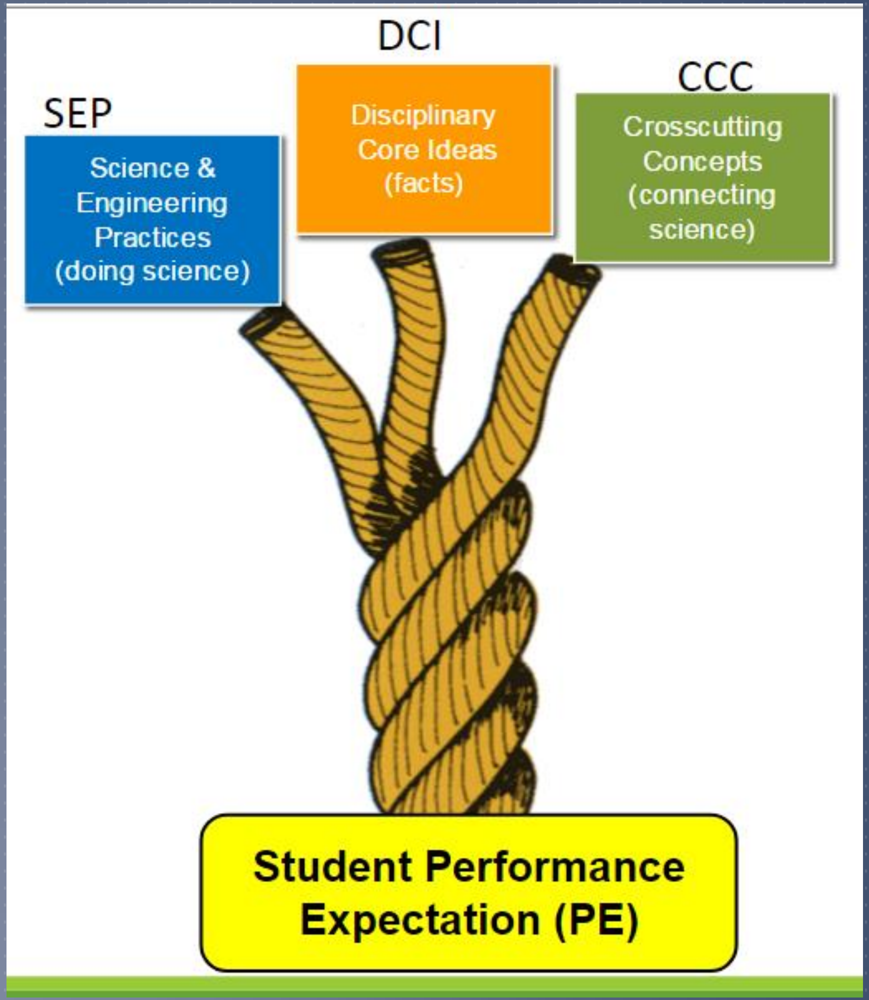
MATTER AND ITS INTERACTIONS

Performance Expectation	Develop models to describe the atomic composition of simple molecules and extended structures.
Clarification Statement	Emphasis is on developing models of molecules that vary in complexity. Examples of simple molecules could include carbon dioxide and water. Examples of extended structures could include sodium chloride or diamonds. Examples of molecular-level models could include drawings, 3-D models, or computer representations showing different molecules with different types of atoms.

Science & Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
1. Asking questions and defining problems 2. **Developing and using models:** Modeling in 6–8 builds on K–5 and progresses to developing, using and revising models to describe, test, and predict more abstract phenomena and design systems. • Develop and/or use a model to predict and/or describe phenomena. 3. Planning and carrying out investigations 4. Analyzing and interpreting data 5. Using mathematics and computational thinking 6. Constructing explanations and designing solutions 7. Engaging in argument from evidence 8. Obtaining, evaluating, and communicating information	**STRUCTURE AND PROPERTIES OF MATTER** Substances are made from 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. (MS.PS1.A.a) Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). (MS.PS1A.e)	**SCALE, PROPORTION, AND QUANTITY** Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small.

3 DIMENSIONS

- Science and Engineering Practices (SEP)
- Disciplinary Core Ideas (DCI)
- Crosscutting Concepts (CCC)
- http://www.nextgenscience.org/three-dimensions



STANDARDS GALLERY WALK

- In your own words, define the following:
  - Performance Expectation
  - Science and Engineering Practices
  - Disciplinary Core Ideas
  - Crosscutting Concepts
- Share and discuss your definitions at the table.
- Using chart paper, write your group's definition of each term.
- Gallery walk

DISSECT A PERFORMANCE EXPECTATION

- Look at a sample PE from the standards issued.
- Determine which part is the SEP, DCI, and CCC by highlighting each part a different color.
- https://www.nextgenscience.org/topic-arrangement/kforces-and-interactions-pushes-and-pulls

Louisiana STUDENT STANDARDS SCIENCE

6

6-MS-PS1-1

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ENERGY

Performance Expectation	Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.
Clarification Statement	Examples of empirical evidence used in arguments could include an inventory or other representation of the energy (i.e. mechanical, thermal, or other forms of energy) before and after the transfer in the form of temperature changes or motion of object. This does not include the quantification of the energy transferred in the system.

Science & Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
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 computational thinking 6. Constructing explanations and designing solutions 7. **Engaging in argument from evidence:** Engaging in argument from evidence in 6–8 builds on 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(s). • Construct, use, and/or present an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. 8. Obtaining, evaluating, and communicating information	**CONSERVATION OF ENERGY AND ENERGY TRANSFER** When the kinetic energy of an object changes, there is inevitably some other change in energy at the same time. (MS.PS3B.a)	**ENERGY AND MATTER** Energy may take different forms (e.g. energy in fields, thermal energy, energy of motion).

SCIENCE AND ENGINEERING?

Card Sort:

- Working with a partner, sort the cards provided into two sets: engineering and science practices.
- Without speaking with your partner, silently think about the differences between the two processes. Then with your partner discuss the differences.

SIMILARITIES AND DIFFERENCES

Engineering practices

- Define a problem
- Obtain, evaluate and communicate information
- Plan designs and tests
- Develop and use models
- Design and conduct tests of prototypes or models
- Analyze and interpret data
- Use mathematics and computational thinking
- Design solutions using evidence
- Engage in argument using evidence

Science practices

- Ask a question
- Obtain, evaluate and communicate information
- Plan investigations
- Develop and use models
- Design and conduct tests of experiments or models
- Analyze and interpret data
- Use mathematics and computational thinking
- Construct explanations using evidence
- Engage in argument using evidence

SCIENCE AND ENGINEERING PRACTICES: DEFINITION

- Describe the major practices that scientists employ as they investigate and build models and theories about the world and a key set of engineering practices that engineers use as they design and build systems.
- The term “practice” is used to emphasize that scientists and engineers use skill and knowledge simultaneously.
- The integration of Science and Engineering Practices with science content represents a shift from previous science standards in Louisiana, giving the learning context and allowing students to apply scientific reasoning and critical thinking to develop their understanding of science.

SCIENCE AND ENGINEERING PRACTICES

- The 8 science and engineering practices are:
  1. Ask questions (science) and define problems (engineering)
  2. Develop and use models
  3. Plan and conduct investigations
  4. Analyze and interpret data
  5. Use mathematical and computational thinking
  6. Construct explanations (science) and design solutions (engineering)
  7. Engage in scientific argument from evidence
  8. Obtain, evaluate, and communicate information

SEP CIRCUS ACTIVITY #1

- Distribute the "Practices Circus chart handout"
- Participants will have ~35 minutes to visit the 7 stations.
- At each station, you should identify the practice best represented by the underlined portion of the prompt.
- After you are finished exploring, you should place a tally mark on the white board to vote for the one practice they identified at each station.

http://www.online-stopwatch.com/countdown-timer/

Practices Circus Key

SCIENTIFIC AND ENGINEERING PRACTICES

Practice	Station 1		Station 2 FLOWER	Station 3 ICE MELTS	Station 4 EGG EARTH	Station 5 YEAST	Station 6		Station 7 DIVER
	SOILS A	SOILS B					CRICKETS A	CRICKETS B	
Asking questions and defining problems						5: asking questions			
Developing and using models			2: models if drawing is for understanding		4: models				
Planning and carrying out investigations	1A: investigations								
Analyzing and interpreting data		1B: data if chart is for analysis					6A: data		
Using mathematics and computational thinking								6B: math	
Constructing explanations and designing solutions				3: explanations					
Engaging in argument from evidence									7: argument
Obtaining, evaluating, and communicating information		1B: communicating if chart is to share info	2: communicating if drawing is to share info						

Adapted from an activity created by the Exploratorium's Institute for Inquiry

California Academy of Sciences, 2013

SEP PROGRESSION

- With a partner, identify and highlight difference(s) in progressions of one SEP between grade levels. SEP #1: Asking questions (10 min.)
- Compare differences identified with your table.
- Differences will be discussed whole group.

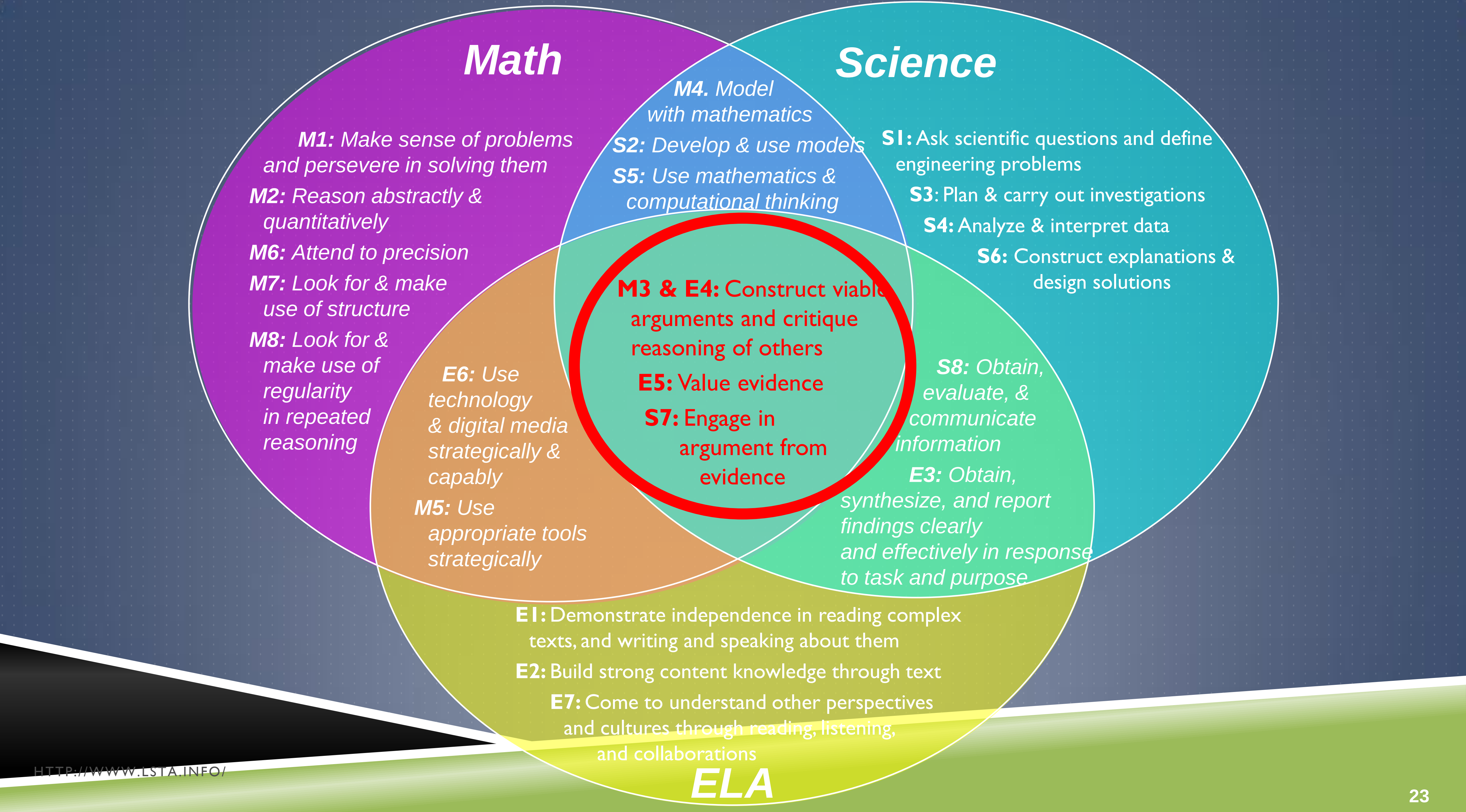
SEP PROGRESSION

- With a partner, place descriptors in the correct grade progression/sequence. (SEP #2: Models)
- Compare your progression with other groups. Make changes if needed.
- Discuss whole group.

Science and Engineering Practices

Developing and Using Models: A practice of both science and engineering is to use and construct models as helpful tools for representing ideas and explanations. These tools include diagrams, drawings, physical replicas, mathematical representations, analogies, and computer simulations. Modeling tools are used to develop questions, predictions and explanations; analyze and identify flaws in systems; and communicate ideas. Models are used to build and revise scientific explanations and proposed engineered systems. Measurements and observations are used to revise models and designs.

K–2 Condensed Practices	3–5 Condensed Practices	6–8 Condensed Practices	9–12 Condensed Practices
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.	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.	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.	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 world(s).
• Distinguish between a model and the actual object, process, and/or events the model represents. • Compare models to identify common features and differences.	• Identify limitations of models.	• Evaluate limitations of a model for a proposed object or tool.	• 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 and/or use a model to represent amounts, relationships, relative scales (bigger, smaller), and/or patterns in the natural and designed world(s).	• 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 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, 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 simple model based on evidence to represent a proposed object or tool.	• 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.	• 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.	• 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.


Math
Science
M4. Model with mathematics
S2: Develop & use models
S5: Use mathematics & computational thinking
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
S1: Ask scientific questions and define engineering problems
S3: Plan & carry out investigations
S4: Analyze & interpret data
S6: Construct explanations & design solutions
M3 & E4: Construct viable arguments and critique reasoning of others
E5: Value evidence
S7: Engage in argument from evidence
E6: Use technology & digital media strategically & capably
M5: Use appropriate tools strategically
S8: Obtain, evaluate, & communicate information
E3: Obtain, synthesize, and report findings clearly and effectively in response to task and purpose
E1: Demonstrate independence in reading complex texts, and writing and speaking about them
E2: Build strong content knowledge through text
E7: Come to understand other perspectives and cultures through reading, listening, and collaborations
ELA
HTTP://WWW.LSTA.INFO/

DISCIPLINARY CORE IDEAS: DEFINITION

- Represent a set of ideas that have broad importance across multiple disciplines; provide a key tool for understanding or investigating more complex ideas and solving problems; relate to the interests and life experiences of students; be teachable and learnable over multiple grades at increasing levels of sophistication.
- Each DCI is <u>what students are supposed to know by the end of the grade level</u> and requires prior knowledge/experience.
- Disciplinary Core Ideas are grouped into five domains:
  1. Physical Science (PS)
  2. Life Science (LS)
  3. Earth and Space Science (ESS)
  4. Environmental Science (EVS)
  5. Engineering, Technology, and Applications of Science (ETS)

PROGRESSION OF DISCIPLINARY CORE IDEAS

- Using the DCI handout-
  - List the main differences between K-2/3-5, 3-5/6-8, 6-8/9-12 and transfer the list to the chart paper

CCC SPEED DATING

- Each participant will be given a card with either the title of a CCC (e.g.; Patterns, Cause and Effect, etc.) or a CCC definition.
- Your task is to mingle around the room looking for your CCC match.
- NOTE: There are multiple copies of each CCC title and definition.
- When you find your match, sit down together at any table to show that you have completed the activity.

Speed Dating Definitions (KEY)

Patterns	The CCC of _____ highlights that structures or events are often consistent and repeated.
Cause and effect	The CCC of _____ investigates how things are connected by identifying the reasons behind an occurrence, and what that occurrence results in.
Scale, proportion, and quantity	Different measures of size and time affect a system's structure, performance, and our ability to observe phenomena.
Systems and system models	The CCC of ______ helps us understand the world by describing how things connect and interact. We can use simple representations to explore these interactions.
Energy and matter	These things are neither created nor destroyed, but may flow into and out of a system and influence its functioning.
Structure and function	The way something is built and the parts that it has determine how it works.
Stability and change	Over time, a system might stay the same or become different, depending on a variety of factors.

CROSSCUTTING CONCEPTS: DEFINITION

- Represent common threads or themes that span across science disciplines (biology, chemistry, physics, environmental science, Earth/space science) and have value to both scientists and engineers because they identify universal properties and processes found in all disciplines.
- Where applicable, each standard includes one of the Crosscutting Concepts, thereby ensuring that the concepts are not taught in isolation but reinforced in the context of instruction within the science content.

CCC STATION ROTATION

- The goal of this activity is begin to see what content or topics might be related to each CCC.
- Each participant will have a worksheet and will be visiting stations 1-7.
- At each station, you will see 3-5 examples of mostly science content that is related to one CCC. Some stations also include examples of non-science content.
- Your task is to identify the CCC that unifies all of the examples at the station. Record your matches on the worksheet.
- The notes column can be used to jot down any thoughts about how you made the match, or ideas of other things that could fit into this CCC.
- You will work in groups of 4-5. You can visit the stations in any order.

CCC STATION ROTATION WRAP-UP

- Do you see any connections or overlap among the CCCs?
- How might the CCCs help integrate science with other subjects?

CCC STATION ROTATION KEY

CCC	Content Example
Patterns	Moon phases, monthly precipitation (SF and Perth, Australia), Fibonacci sequence
Cause and Effect	Rachel and Alex juice story, population changes, Rube Goldberg
Scale, proportion, and quantity	Solar system and football field, large sample size, female participants
Systems and system models	US gov't., human circulatory system, water cycle
Energy and matter	Trophic levels, fire images, E=mc2
Structure and function	Predator and prey, sustainable design, bridges
Stability and change	Rock cycle, insect life cycles, temperature/CO2

WHAT DOES THIS LOOK LIKE IN A CLASSROOM?

- https://www.nextgenscience.org/resources/video-making-claims-evidence

SUMMARY: CONCEPTUAL SHIFTS

- Reflects how science is done in the real-world by intertwining the 3 dimensions.
- Are student performance expectations-NOT curriculum.
- Builds coherently from grades K through12.
- Focuses on deeper understanding of content and application.
- Integrates science, technology, and engineering.
- Aligns with math and ELA standards.

RESOURCES

- http://www.louisianabelieves.com/resources/library/academic-standards
- https://www.nap.edu/catalog/13165/a-framework-for-k-12-science-education-practices-crosscutting-concepts
- http://www.nextgenscience.org/
- https://www.calacademy.org/educators/ngss-demystified-training-video-gallery
- http://www.lsta.info/
- http://www.nsta.org/

QUESTIONS

- Contact Information

Before you leave…

  - Establish a network of colleagues to share information.
  - Share contact information with those at your table.
- EXIT TICKET & TREAT!!

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