DISSECTING LOUISIANA SCIENCE STANDARDS FOR HIGH SCHOOL

Louisiana Science Teachers Association

Teacher Leader Summit - June 8, 2017

Presenters

- Nathan Cotten, LSTA President
- Patrice Mire, LSTA Vice President
- Jeff Holcomb, LASL Past President
- Casey McMann, Standards Workgroup Member

Louisiana Science Teachers Association

Louisiana Student Standards for Science

The Department will provide multiple phases of support as districts and teachers work to implement the Louisiana Student Standards for Science.

PHASE	TIMELINE	FOCUS
Phase 1	*Spring – Summer 2017*	• Framework and make-up of the standards • Shifts in science instruction • Progressions of learning
Phase 2	*Fall 2017*	• Educators begin implementation of the new standards, practice implementing aligned tasks, pilot 3-dimensional lessons • LDOE releases scope and sequence documents, revised instructional tasks, sample EAGLE items
Phase 3	*Spring –Summer 2018*	• Quality curriculum piloted • Suite of assessment items/item sets released on EAGLE • Field test in grades 3-8

Contact LouisianaStandards@la.gov with questions.

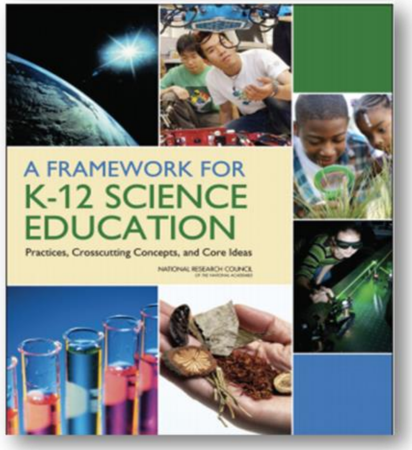
Before you leave today…

Louisiana Science Teachers Association

- 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 some possible next steps
  - Expand your network of colleagues
- You will still need to:
  - Continue the process of understanding the standards 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

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.



The Need For New Standards

- Why did we need new science standards? (Or did we?)
- Recent studies have shown that students begin forming complex ideas and explanations at an early age.
- Research has shown that content and the process of learning must be taught in tandem.
- Research has proven that depth is more important to student learning than breadth.
- https://www.slideshare.net/djharland/ngss-070913-wip5-actual-copy

The Need For New Standards

- The last time Louisiana adopted new science standards…
  - You could purchase a camera for $2000 that could store 20 minutes of video or 3000 pictures at 0.3 megapixels.
  - You could purchase the first digital MP3 music player for $400 that could hold 6 of your favorite songs.
  - There were 111 elements vs. 118 today.
  - The human genome had not been completely mapped.

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Where can I find the new science standards?

- http://www.louisianabelieves.com/resources/library/academic-standards
- Be sure to select LSS science standards for your grade/subject.

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Standards Are Based on the *Framework*

- Children are born investigators
- Understanding builds over time
- Science and engineering require both knowledge and practice
- Connect content to students' interests and experiences
- Content is connected across ALL disciplines
- Express ideas grounded in scientific evidence
- Prepare students to be scientific literate citizens (college and career ready)
- *A Framework for K-12 Science Education*

Domains

- Louisiana Science Standards are broken down into 5 domains.
  - Physical Science (PS)
  - Life Science (LS)
  - Earth and Space Science (ESS)
  - Environmental Science (EVS)
  - Engineering, Technology and Applications of Science (ETS)

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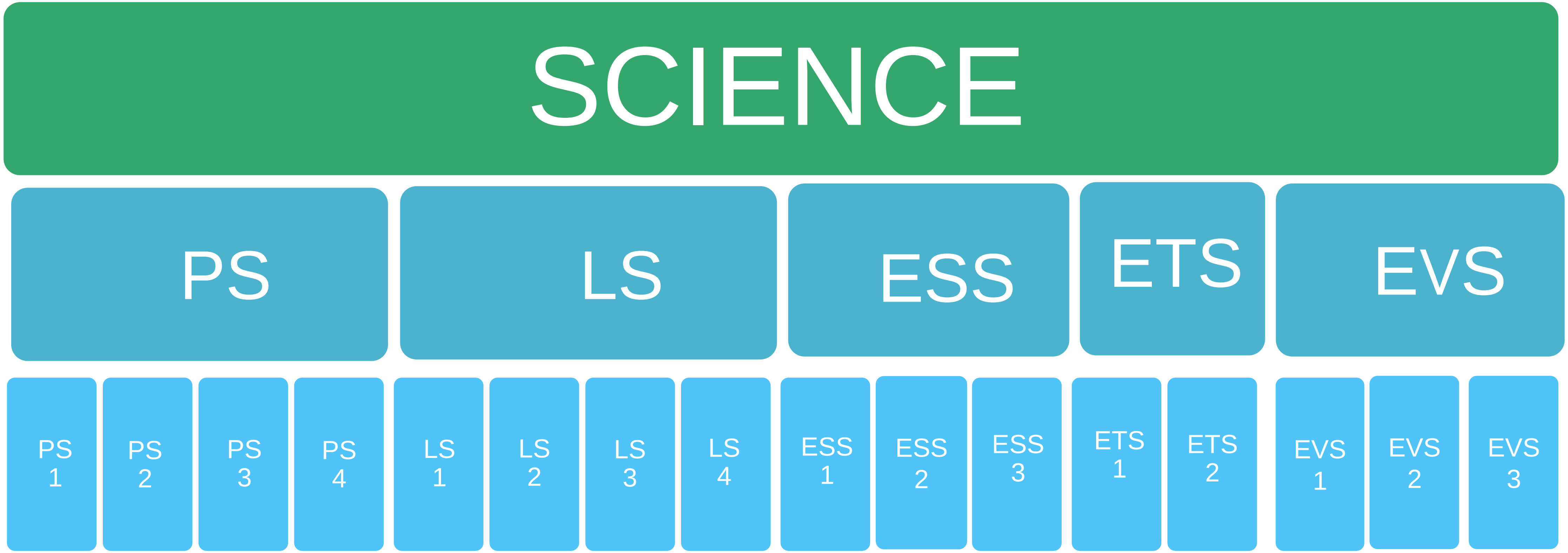
SCIENCE				
PS	LS	ESS	ETS	EVS

Domains



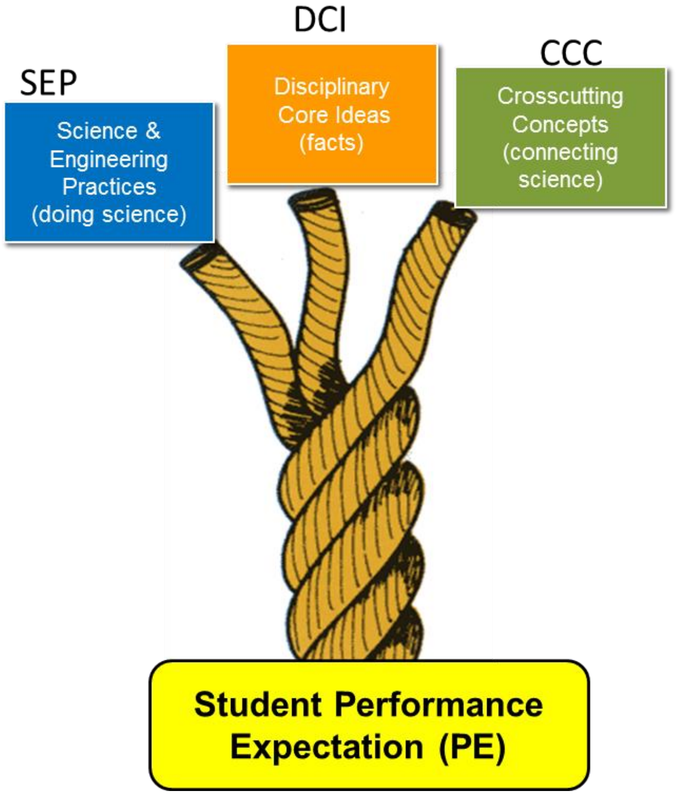
Disciplinary Core Ideas
DCIs

SCIENCE

PS				LS				ESS			ETS		EVS		
PS 1	PS 2	PS 3	PS 4	LS 1	LS 2	LS 3	LS 4	ESS 1	ESS 2	ESS 3	ETS 1	ETS 2	EVS 1	EVS 2	EVS 3
PS1.A	PS2.A	PS3.A	PS4.A	LS1.A	LS2.A	LS3.A	LS4.A	ESS1.A	ESS2.A	ESS3.A	ETS1.A	ETS2.A	EVS1.A	EVS2.A	EVS3.A
PS1.B	PS2.B	PS3.B	PS4.B	LS1.B	LS2.B	LS3.B	LS4.B	ESS1.B	ESS2.B	ESS3.B	ETS1.B	ETS2.B	EVS1.B	EVS2.B	
PS1.C	PS2.C	PS3.C	PS4.C	LS1.C	LS2.C		LS4.C	ESS1.C	ESS2.C	ESS3.C	ETS1.C			EVS2.C	
		PS3.D		LS1.D	LS2.D		LS4.D		ESS2.D	ESS3.D					
									ESS2.E						

3-Dimensional Learning

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



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Vocabulary Gallery Walk

- In groups of 4-6, divide your chart paper into 4 quadrants (one for each of the following: PE, SEP, DCI, and CCC).
- Define what each part means. You can use examples.
- Gallery walk with sticky notes (3 min/station)
- Finalize your definition of each. Be prepared to share.
- Which of these parts is the standard?

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Performance Expectation: Definition

- Performance Expectations represent what the students should know and be able to do to be proficient in science.
- Performance Expectations are built using all three dimensions:
  - Science and Engineering Practices
  - Disciplinary Core Ideas
  - Crosscutting Concepts
- **All components** are a part of each standard providing clarity and guidance for instructors.

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FROM MOLECULES TO ORGANISMS: STRUCTURES AND PROCESSES

Performance Expectation	Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis in living organisms.
Clarification Statement	Examples of investigations could include heart rate responses to exercise, stomate responses to moisture and temperature, root development in response to water levels, or cell response to hypertonic and hypotonic environments.

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:** Planning and carrying out investigations to answer questions or test solutions to problems in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models. • Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. 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 FUNCTION** Feedback mechanisms maintain a living system's internal conditions within certain limits and mediate behaviors, allowing the organism to remain alive and functional even as external conditions change within some range. Feedback mechanisms can promote (through positive feedback) or inhibit (negative feedback) activities within an organism to maintain homeostasis. (HS.LS1A.d)	**STABILITY AND CHANGE** Feedback (negative or positive) can stabilize or destabilize a system.

Dissect a Performance Expectation

- Look at a sample PE from the standard issued.
- Determine which part is the SEP, DCI, CCC.
  - Circle the SEP.
  - Underline the DCI.
  - Box the CCC.
- https://www.nextgenscience.org/topic-arrangement/kforces-and-interactions-pushes-and-pulls

Science or Engineering?

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

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

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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

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SEP Circus Activity #1

- Distribute the "Practices Circus Chart Hand Out"
- Participants will have ~20 minutes to visit the 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 you identified at each station.

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


TIME FOR
LUNCH
TIME FOR

SEP Progression Activity #2

- With a partner, identify and highlight difference(s) in progressions of one SEP between grade levels.

  SEP #1: Asking questions (10 min.)

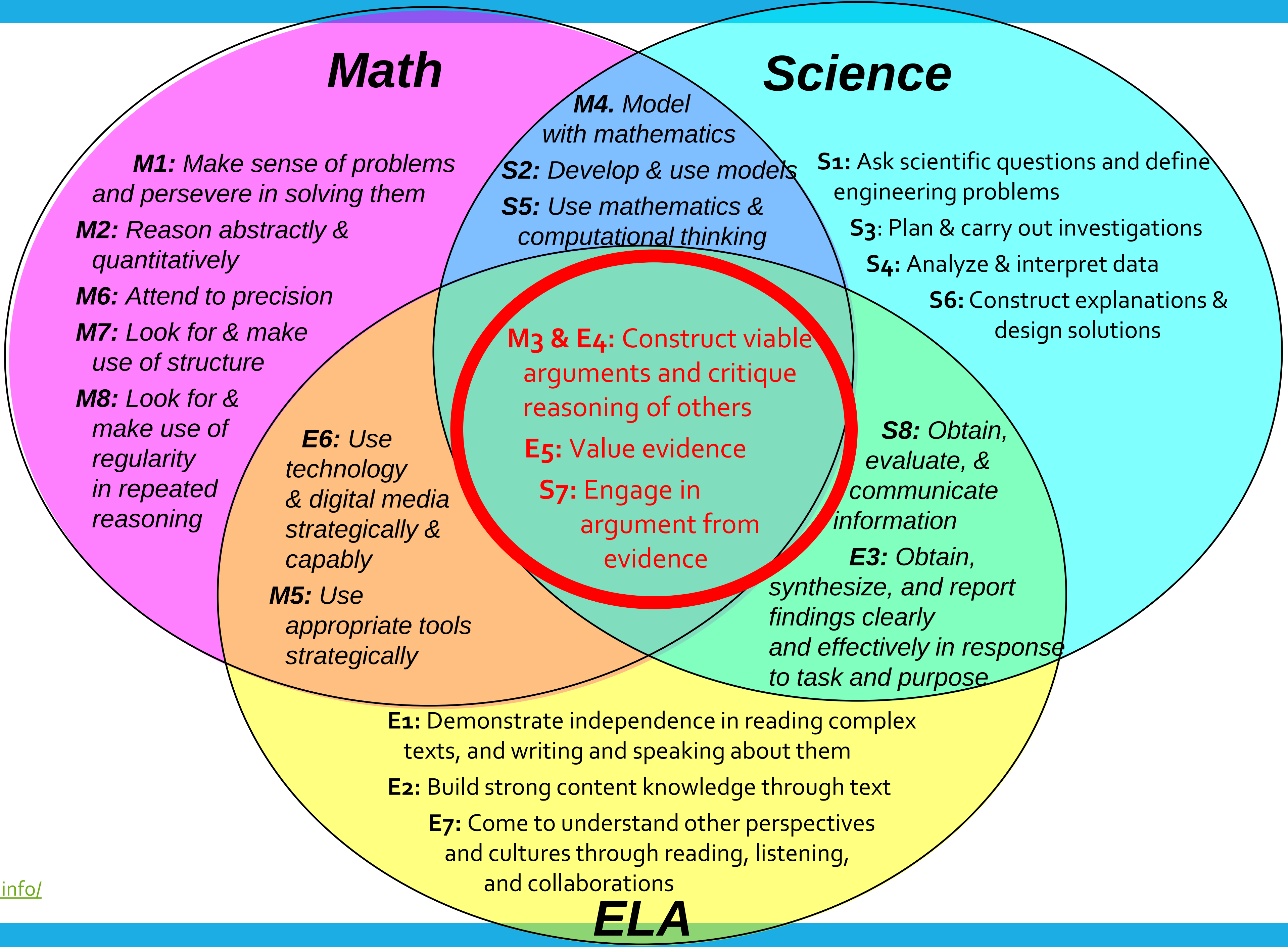
- Compare differences identified with your table.
- Differences will be discussed whole group.

SEP Progression Activity #3

- 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.

Practices in Different Disciplines

Math	Science	English Language Arts
M1. Make sense of problems and persevere in solving them.	S1. Asking questions (for science) and defining problems (for engineering).	E1. They demonstrate independence.
M2. Reason abstractly and quantitatively.	S2. Developing and using models.	E2. They build strong content knowledge.
M3. Construct viable arguments and critique the reasoning of others.	S3. Planning and carrying out investigations.	E3. They respond to the varying demands of audience, task, purpose, and discipline.
M4. Model with mathematics.	S4. Analyzing and interpreting data.	E4. They comprehend as well as critique.
M5. Use appropriate tools strategically.	S5. Using mathematics, information and computer technology, and computational thinking.	E5. They value evidence.
M6. Attend to precision.	S6. Constructing explanations (for science) and designing solutions (for engineering).	E6. They use technology and digital media strategically and capably.
M7. Look for and make use of structure.	S7. Engaging in argument from evidence.	E7. They come to understand other perspectives and cultures.
M8. Look for and express regularity in repeated reasoning.	S8. Obtaining, evaluating, and communicating information.	



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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 describes what students are supposed to know by the end of the grade level 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)

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Progression Activity of HS DCI

- Progression Activity of DCI (10 min)
- Highlight differences on handout (10 min)
- List main differences between K-2/3-5, 3-5/6-8, 6-8/9-12 (10 min) and transfer list to poster (10 min)
- Compare whole group/gallery walk (20 min).
- Each group will verify list and identify any differences.
- Differences will be discussed whole group.

CCC Speed Dating Activity

- Each participant will blindly draw 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 their CCC match.
- NOTE: There are multiple copies of each CCC title and definition.
- When you find your match, the pair or group should sit down together at any table to show they have completed the activity.

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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 Activity

- 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 Key

CCC	Content Example
Patterns	Moon phases, monthly precipitation (SF and Perth, Austrailia), 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/CO_2

CCC Station Rotation Wrap-Up

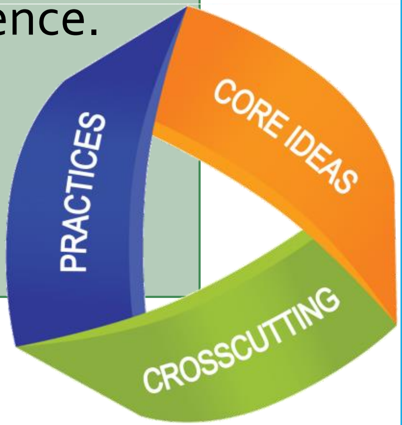
- Will finding classroom connections for these ideas be easy or challenging?
- Do you see any connections or overlap among the CCCs?
- How might the CCCs help integrate different domains of science?
- How might the CCCs help integrate science with ELA, math, and social studies?

Crosscutting Concepts

- The 7 crosscutting concepts are:
  1. Patterns
  2. Cause and Effect: Mechanisms and explanations
  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

Summary of LSS Parts

Coding and Descriptor (example: 2-PS1-3 Matter and Its Interactions)		
Performance Expectation: States what students should be able to do to demonstrate that they have met the standard. Performance expectations are built on the foundation of the science and engineering practices, disciplinary core ideas, and crosscutting concepts.		
Clarification Statement: Provides examples or additional clarification of the performance expectation.		
Science and Engineering Practices: Detail the behaviors that students should engage in that mimic those of scientists and engineers.	**Disciplinary Core Ideas**: Describe the most essential ideas (content) in the major science disciplines.	**Crosscutting Concepts**: Ideas that have applications across all areas of science.



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What does this look like in a classroom?

- https://www.teachingchannel.org/videos/transition-to-ngss-achieve
- How can "flipping" the order in which students receive information help students develop deep understanding of concepts?
- How do the students and teacher work together to address misconceptions and build science knowledge?
- What are the first steps you might take to start implementing NGSS in your own classroom?

Next Steps

- List the 3 most important suggestions to tell your **district/school** in order to make the shift to the new standards.
- List the 3 most important needs and/or challenges **teachers** face in order to make the shift to the new standards.
- List the 3 most anticipated needs and/or challenges **students** will confront when trying to meet the performance expectations.
- Brainstorm suggestions to address these challenges.

Depth vs. Breadth

Grade	Number of GLEs	Number of LSS for Science
Kindergarten	32	10
3rd grade	62	15
6th grade	87	18
HS Biology	58	20
HS Chemistry	63	13
HS Physics	51	12

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Louisiana Student Standards for Science

The new standards call for changes in the science classroom. Key shifts called for by the Louisiana Student Standards for Science:

Apply content knowledge	Content knowledge is critical and evident in the standards in the Disciplinary Core Ideas, the key ideas in science that have broad importance within or across multiple science or engineering disciplines. However, simply having content knowledge is not enough. Students must investigate and apply content knowledge to scientific phenomenon.
Investigate, evaluate, and reason scientifically	Scientists do more than learn about science; they “do” science. Science instruction must integrate the practices, or behaviors, of scientists and engineers as they investigate real-world phenomenon and design solutions to problems.
Connect ideas across disciplines	For students to develop a coherent and scientifically-based view of the world, they must make connections across the domains of science (life science, physical science, earth and space science, environmental science, and engineering, technology, and applications of science). The crosscutting concepts have applications across all domains.

Three Dimensional Learning: the integration of the Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts in science instruction

Contact LouisianaStandards@la.gov with questions.

Louisiana Student Standards for Science

Area	Support and Timeline
Curriculum and Resources LouisianaStandards@la.gov	**Instructional Materials Review** ● Rubric released and call for submissions ● TLA's: hiring (applications due June 13) and training (June 28-29) ● First review released - *Fall 2017* **New Standards Tools** ● Connections to ELA and math standards* ● Key shifts and instructional implications* ● Middle School sample transition plan - *June 2017* ● Sample scope and sequence documents - *Summer 2017* *To access standards tools, click on the links above, click "download" next to "K-12 Louisiana Student Standards for Science (2017)," then open the zip file that downloads on your computer.

Louisiana Student Standards for Science

Area	Support and Timeline
Professional Development LouisianaStandards@la.gov	**Self-paced Learning** Live and recorded webinars on new standards • Monday, June 19 @ 9:00 a.m. - LSS Science Series Part 1: Overview of the Louisiana Student Standards for Science • Monday, June 26 @ 9:00a.m. - LSS Science Series Part 2: Instructional Shifts • Monday, July 10 @ 9:00 a.m. - LSS Science Series Part 3: Three-Dimensional Learning • Monday, July 17 @ 9:00 a.m. - LSS Science Series Part 4: Learning Progressions • Monday, July 24 @ 9:00 a.m. - LSS Science Series Part 5: Phenomenon-Based Instruction **Summer Opportunities** • Louisiana Tech will provide intensive four-day summer training institutes this summer in both north and south Louisiana • LSU Cain Center will provide summer training in an intensive two-day workshop to be held in June in Baton Rouge **Collaborations** • Sessions at 2017-2018 collaborations

KEYNOTE SPEAKER: DEBBIE SILVER

Dr. Debbie Silver is an award-winning teacher and one of the most popular keynoters and professional development presenters in the United States.

New Orleans Area Conference

November 30–December 2, 2017

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For more information, visit http://www.nsta.org/conferences/

Louisiana Student Standards for Science

Area	Support and Timeline
Assessment Email assessment@la.gov with questions	**Previous RFP secured vendor for assessment development** ● Field test for grades 3-8 – *Spring 2018* ● Operational test – *Spring 2019* ● Platform the same as ELA, Math, Social Studies, and EAGLE **EAGLE Assessment Tool** ● Teacher Leader Advisors, who will help create sample assessment items, hired and trained Summer 2017 ● EAGLE items created throughout the 2017-2018 school year

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/

Louisiana Science Teachers Association

Questions

- Contact Information
  - Nathan Cotten, nathancotten@tpsd.org
  - Patrice Mire, Patrice.mire@vpsb.net
  - Jeff Holcomb, jeff.holcomb@bossierschools.org
  - Casey McMann, cmcmann@ppsb.org

Before you leave…
  - Establish a network of colleagues to share information.
  - Share contact information with those at your table.

Louisiana Science Teachers Association

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