SCIENCE STANDARDS ON THE GEAUX
Teacher Leader Summit
New Orleans Convention Center

Presented by: Jean May-Brett, Steven Babcock

Thursday, June 8, 2017
Session 8: 10:05-11:35
Lunch: 11:45-1:15
Session 9: 1:30-3:00
Session 10: 3:30-5:00

Agenda

* **LDOE Implementation Timeline**
* Framework
* Three-dimensional Learning
* Instructional Shifts
* LDOE Implementation Resources and Support

Introduction

Louisiana State Standards

Louisiana state law RS 17:24.4 requires BESE to adopt academic content standards, which are defined in the law as statements that define what a student should know or be able to accomplish at the end of a specific time period, grade level or at the completion of a course.

The law sets forth an expectation that standards be rigorous and that they represent the knowledge and skills needed for students to successfully transition to postsecondary education and the workplace, as determined by content experts, elementary and secondary educators and school leaders, postsecondary education leaders, and business and industry leaders.

BESE Bulletin 741, §2301 states, "The Louisiana content standards shall be subject to review and revision to maintain rigor and high expectations for teaching and learning."

Louisiana Science Standards

In accordance with state law, the science review process is being led by content experts, elementary and secondary educators, postsecondary education leaders, and business and industry leaders. BESE has also provided for extensive participation by parents of Louisiana school children and the general public, both through the online review portal and in standards review committee meetings.

BESE solicited nominations statewide from several education associations, local school systems, and key stakeholder organizations representing parents and business and industry leaders. From these nominations, the board assembled a diverse group of 86 individuals representing every sector mentioned in the law, as well as every geographic region of the state.

These volunteers are serving on a standards review committee and two content workgroups, each led by a designated chairperson.

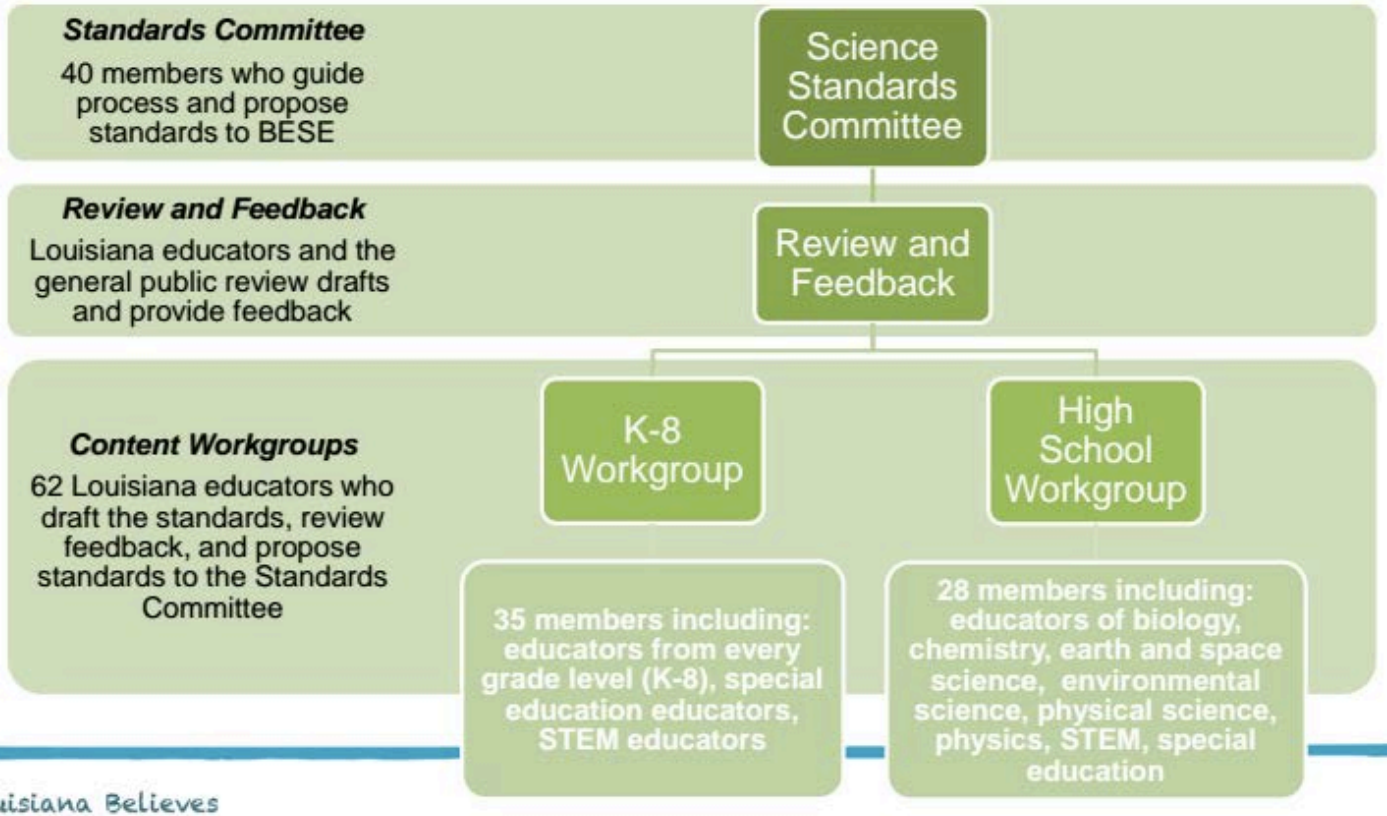
Research Based

"Facts are not science- as the dictionary is not literature."

-Martin H. Fischer 1944

- Historically, K-12 science education has emphasized factual knowledge and encouraged mile wide and inch deep teaching and learning.
- According to the National Research Council, "Science is not just a body of knowledge that reflects current understanding of the world; it is also a set of practices used to establish, extend and refine that knowledge. Both elements – knowledge and practice- are essential." NRC 2012
- The new standards adopted by Louisiana represent a shift in education to help our students meet the demands of changing world.

Standards Committee & Workgroups



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

House keeping……

* If you think of questions make sure and write them on post-it notes and put them into our parking lot in case they aren't addressed in discussion.
* Use your journal to develop a playbook for bringing ideas back to your districts and schools.
* It's a lot to go through so please be patient!

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* **Framework**
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Overview of Standards

Quality standards provide focus on fewer topics with more opportunities for students to engage deeply.

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

Overview of Standards

- Quality standards provide focus on fewer topics with more opportunity for students to engage deeply.
- Quality standards identify key student knowledge and skills that students should demonstrate by the end of the year.
- Quality standards connect learning within and across grades.

Past Science Instruction	Drafted Louisiana Student Standards for Science
Focus on content acquisition	Students develop and apply knowledge in new situations
Many topics, little depth	Fewer topics, more depth
Teacher dominated discourse and instruction	Students engage in developmentally appropriate experiences using similar behaviors as a scientist

Overview of Standards

Quality standards identify key student knowledge and skills that students should demonstrate by the end of the year.

7-MS-LS2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. CS: Emphasis is on recognizing patterns in data, making inferences about changes in populations, and on evaluating empirical evidence supporting arguments about changes in ecosystems.		
SEP: 7. Engaging in argument from evidence: 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.	DCI: Ecosystem Dynamics, Functioning, and Resilience Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations.	CC: Stability and Change: Small changes in one part of a system might cause large changes in another part.

Examining the vocabulary and structure of the Louisiana Student Standards in Science

Framework of LSS for Science

Coding and Descriptor		
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.

Examining the vocabulary and structure of the Louisiana Student Standards in Science

Science and Engineering Practices

Determine which of the practices correlate to the given performance expectations.

1. Asking questions (science) and defining problems (engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (science) and designing solutions (engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

Examining the vocabulary and structure of the Louisiana Student Standards in Science

Disciplinary Core Ideas

Physical Science	PS1: Matter and its interactions PS2: Motion and stability: Forces and Motions PS3: Energy PS4: Waves and their applications in technologies for information transfer
Life Science	LS1: From molecules to organism: Structures and processes LS2: Ecosystems: Interactions, energy, and dynamics LS3: Hereditary: Inheritance and variation of traits LS4: Biological evolution: Unity and diversity
Earth and Space Science	ESS1: Earth's place in the universe ESS2: Earth's systems ESS3: Earth and Human activity
Engineering, Technology, and Applications of Science	ETS1: Engineering design ETS2: Links among engineering, technology, science, and society

Examining the vocabulary and structure of the Louisiana Student Standards in Science

Crosscutting Concepts

Determine which of the crosscutting concepts correlate to the given performance expectations.

1. Patterns
2. Cause and effect
3. Scale, proportion, and quantity
4. Systems and system models
5. Energy and matter
6. Structure and function
7. Stability and change

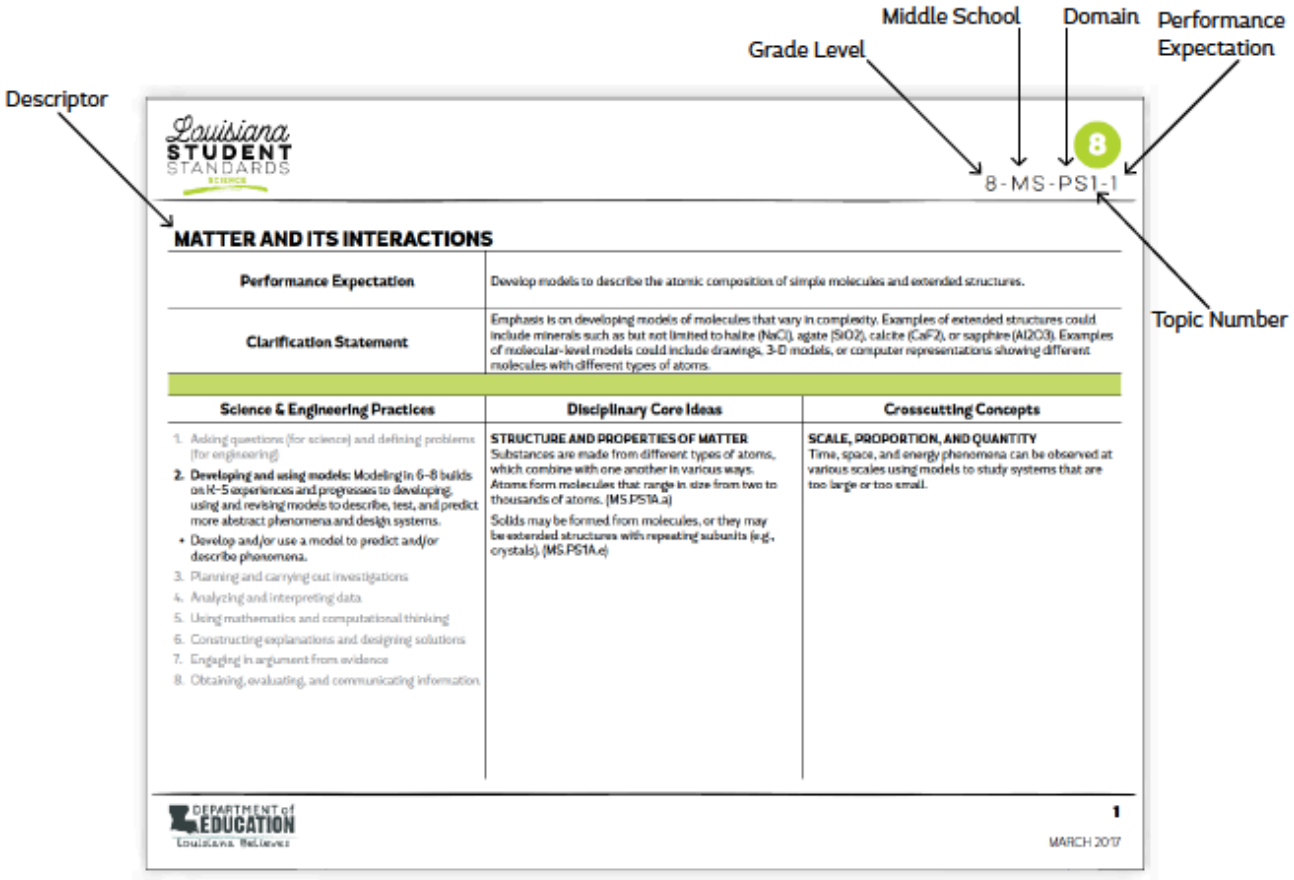
Examining the vocabulary and structure of the Louisiana Student Standards in Science

Interpreting Standard Codes

Each performance expectation is identified by a code and descriptor. The coding is derived by the following formula: Grade level-Domain and Topic Number- Performance Expectation Number (space)

3-PS2-1 **Motion and Stability: Forces and Interactions**	The grade level is 3, the domain is Physical Science, the topic number is 2, and the performance expectation number is 1. The descriptor is, "Motion and Stability: Forces and Interactions."
7-MS-ESS2-4 **Earth's Systems**	The grade level is 7, the standard is middle school, the domain is Earth and Space Science, the topic number is 2, and the performance expectation is 4. The descriptor is, "Earth's Systems."
HS-LS1-1 **From Molecules to Organisms: Structures and Processes**	The standard is high school, the domain is Life Science, the topic number is 1, and the performance expectation number is 1. The descriptor is, "From Molecules to Organisms: Structures and Processes."

Examining the vocabulary and structure of the Louisiana Student Standards in Science



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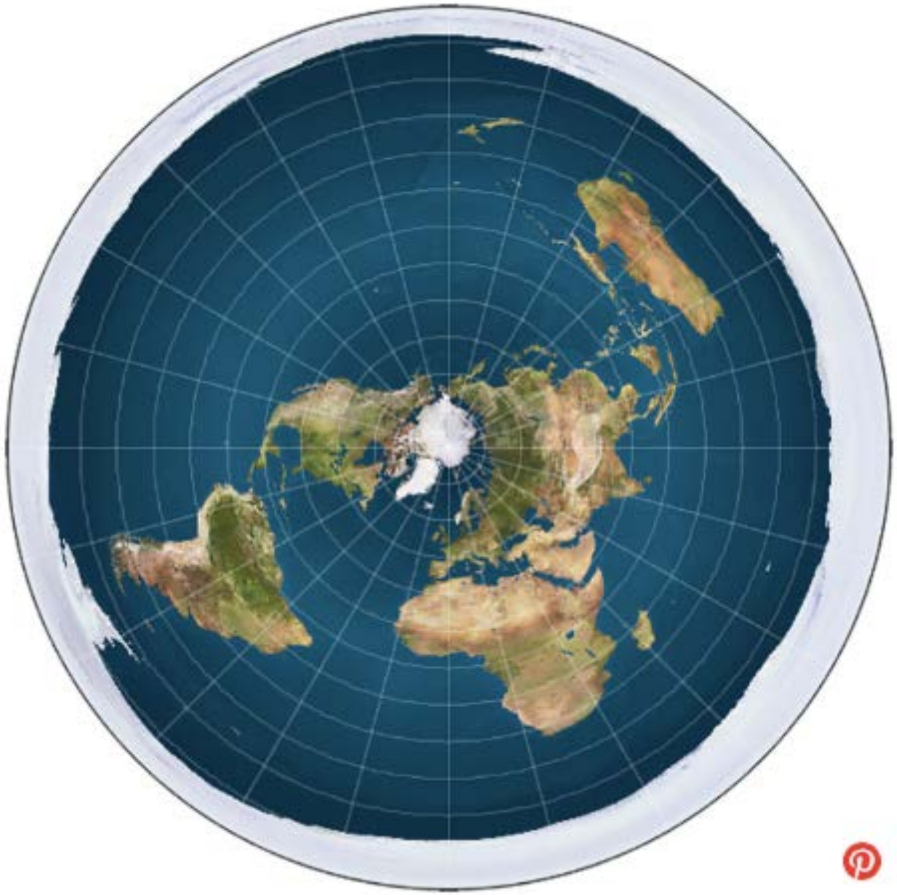
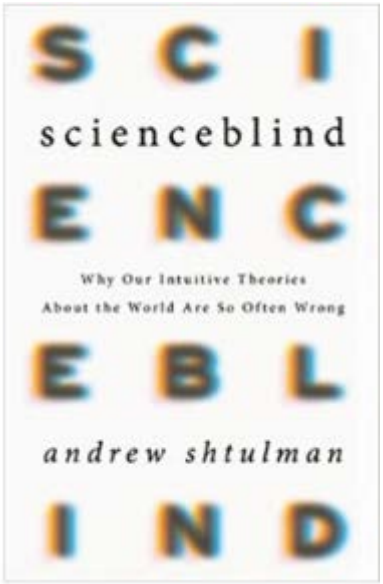
Flat Earth?




IF THE EARTH WAS FLAT

What does this all mean for science education?

* http://blogs.sciencemag.org/books/2017/04/27/podcast-qa-with-andrew-shtulman-author-of-scienceblind/



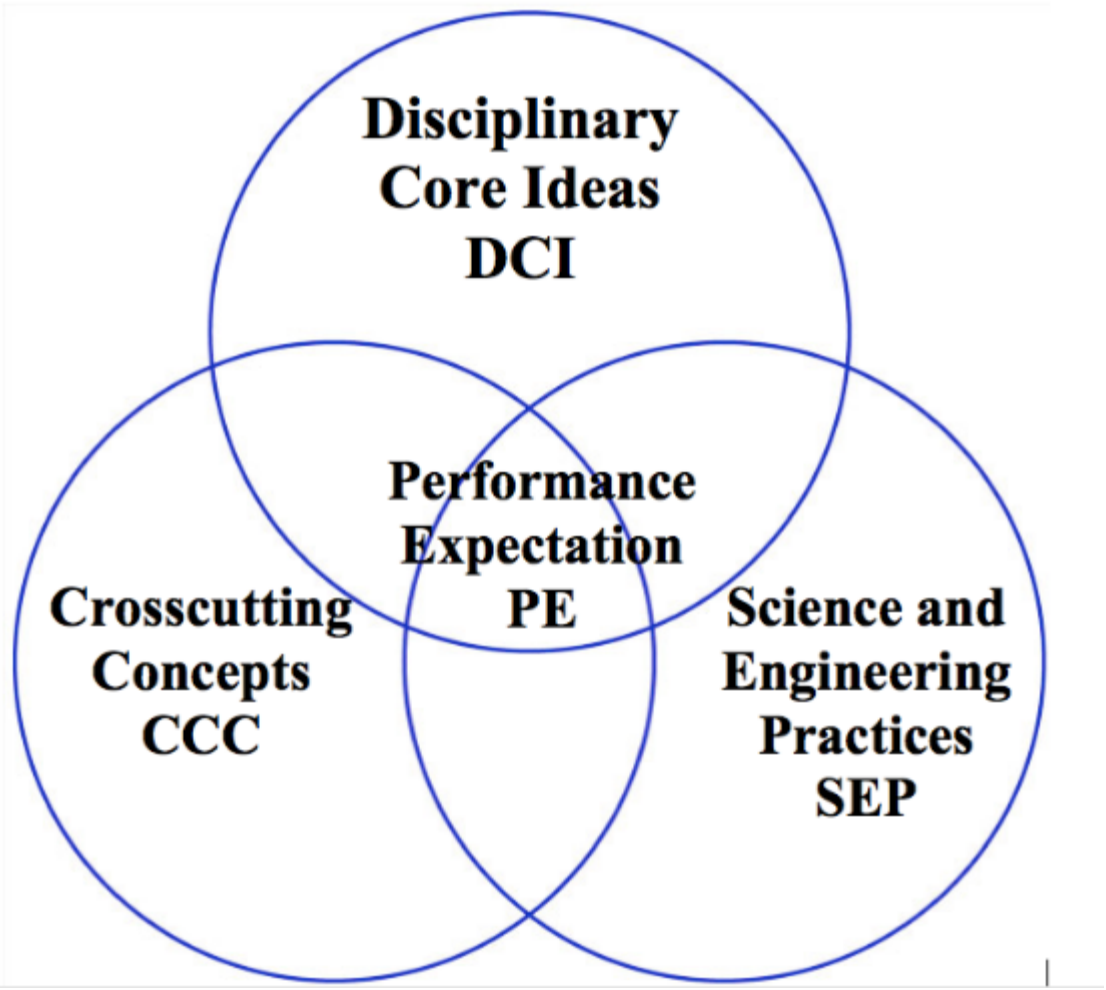
What is 3-D Learning?

Louisiana's New Standards Represent a Conceptual Shift in Teaching And Learning

Conceptual Shift: Science education that looks like science!

* "...learning about science and engineering involves integration of the knowledge of scientific explanations (i.e., content knowledge) and the practices needed to engage in scientific inquiry and engineering design. Thus the framework seeks to illustrate how knowledge and practice must be intertwined in designing learning experiences in K–12 science education."

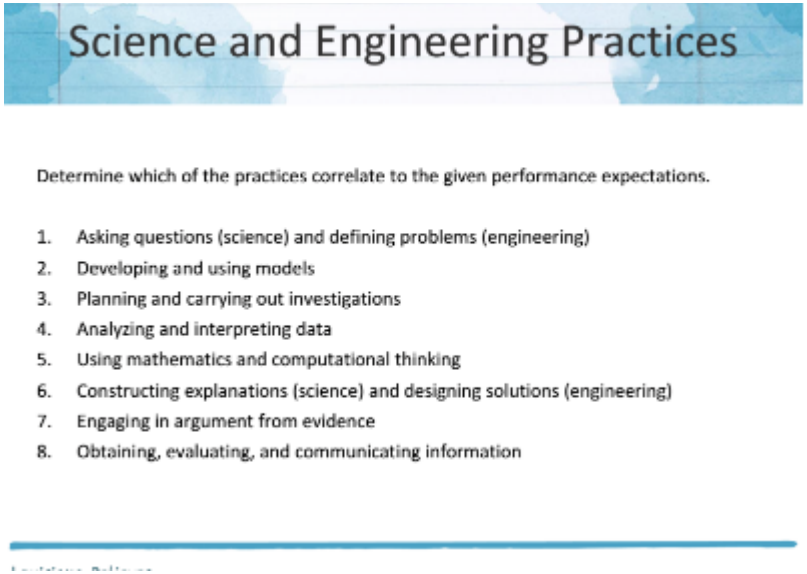
* (2011). A Framework for K-12 Science Education: Practices, crosscutting concepts, and core ideas. (p. 11). Washington, DC: The National Academies Press. Retrieved from http://www.nap.edu/catalog.php?record_id=13165


Disciplinary
Core Ideas
DCI
Performance
Expectation
PE
Crosscutting
Concepts
CCC
Science and
Engineering
Practices
SEP

Digging Deeper….

Science and Engineering Practices

* Take time to review the standards pages but don't get in the weeds…. Your task is to brainstorm an operational definition of this component of a standard. At your table create a chart/poster that shows your thinking.



Science and Engineering Practices

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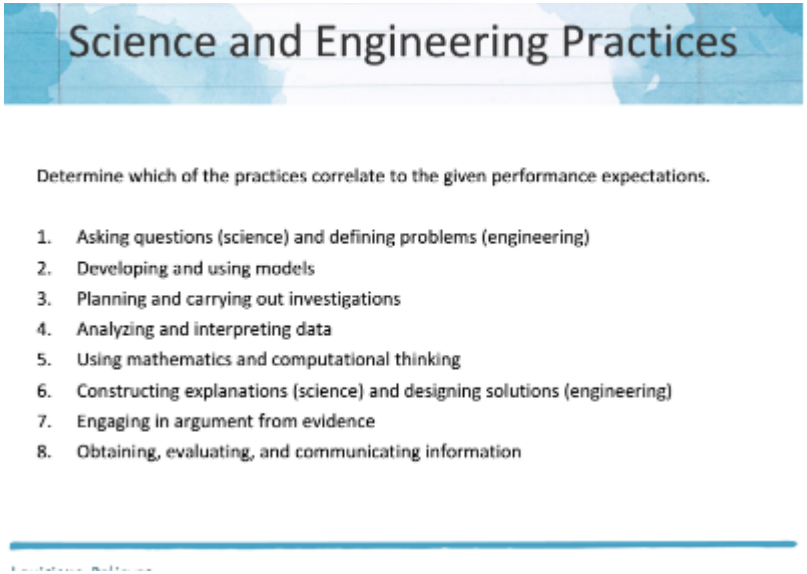
Digging Deeper….

Science and Engineering Practices

* As you move around the room on your gallery walk take note of our shared understanding of SEP.



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Digging Deeper….

Disciplinary Core Ideas

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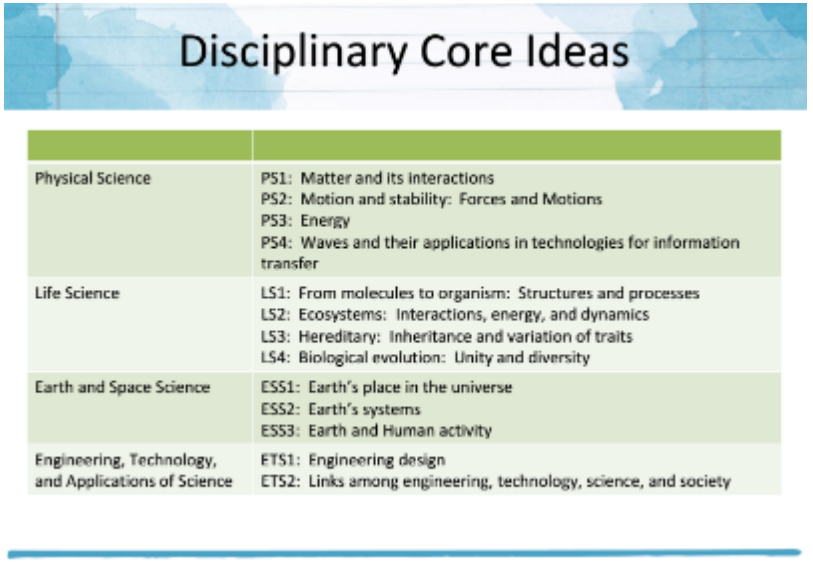

Disciplinary Core Ideas

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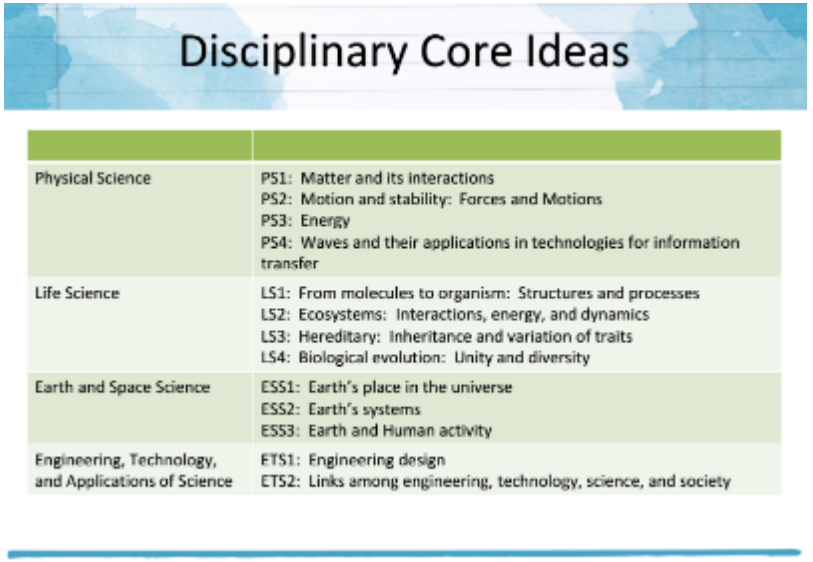
Earth and Space Science	ESS1: Earth's place in the universe ESS2: Earth's systems ESS3: Earth and Human activity
Engineering, Technology, and Applications of Science	ETS1: Engineering design ETS2: Links among engineering, technology, science, and society

Digging Deeper….

Disciplinary Core Ideas

* As you move around the room on your gallery walk take note of our shared understanding of DCI.



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Lightning Round of Speed Dating

Mixing and Getting to know the CCC

Lightning Round of Speed Dating

Half of you will receive cards listing one of the Cross Cutting Concepts.

Half of you will receive cards defining the Cross Cutting Concepts.

All of you will find your perfect match!

Lightning Round of Speed Dating

Now that you've found your match… share what you teach and what course topics you think might illustrate this CCC.

Performance Expectations

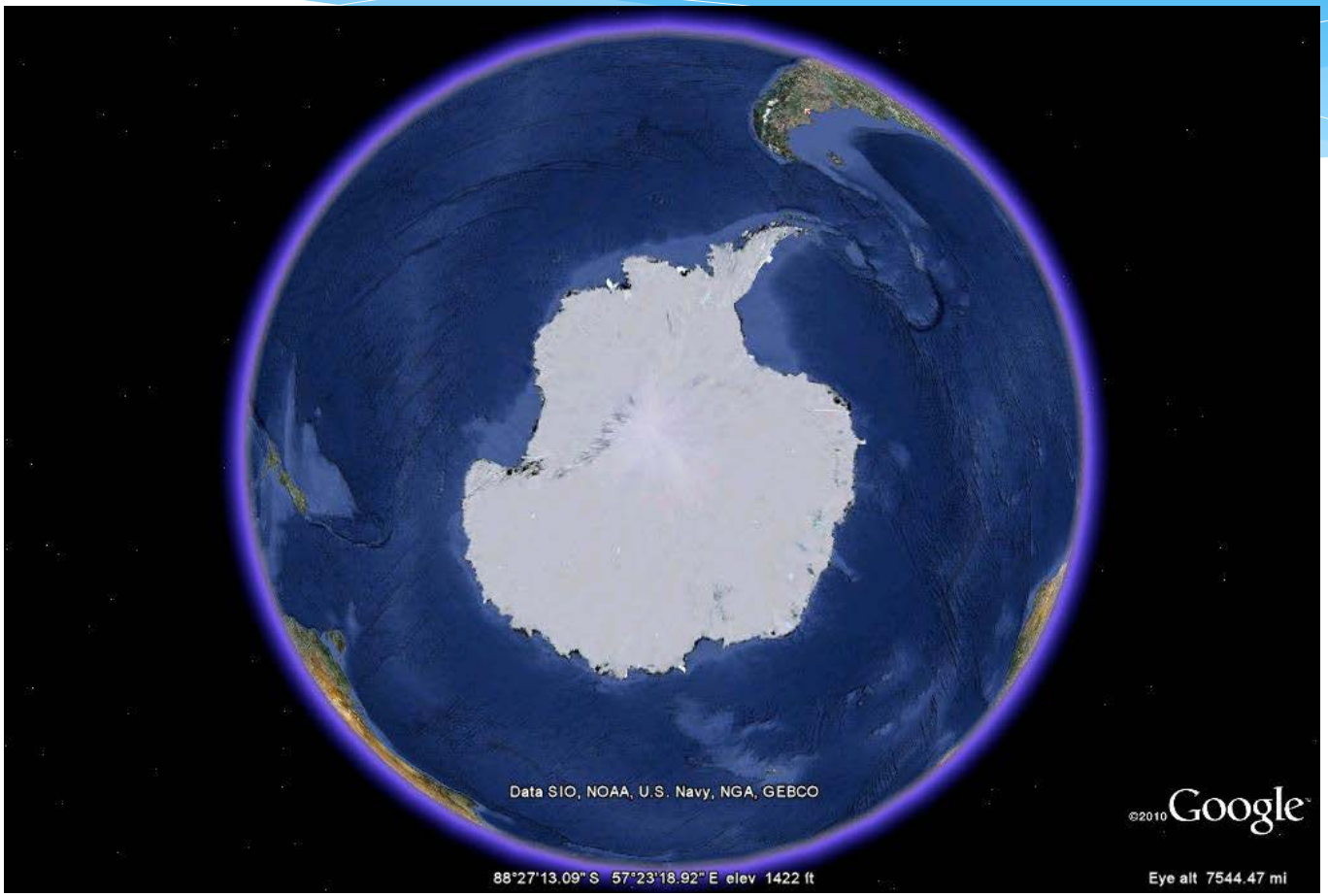
Do Not	Do
Specify every intermediate piece of knowledge needed to demonstrate the performance expectation	Leave room for teachers and curriculum writers to support student understanding
Prescribe the instructional steps	Describe what students should know and be able to do to demonstrate at the conclusion of instruction
Encourage students to read a textbook and answer questions at the end	Encourage students to read multiple sources, including science journals and magazines, and web-based resources.
Encourage "lecture" classrooms or asking students questions with a right/wrong answer.	Encourage students to perform investigations, solve problems, and engage in open-ended discussion.

Examining the vocabulary and structure of the Louisiana Student Standards in Science

* Take a few minutes to explore a sample standards page from your discipline.
* At your table create a chart that shows the different components of a standard.
* Define each component.
* Describe how the standards are similar/different from GLE's.
* Discuss specific examples of content you currently teach and how the 3D approach may require adjustments.

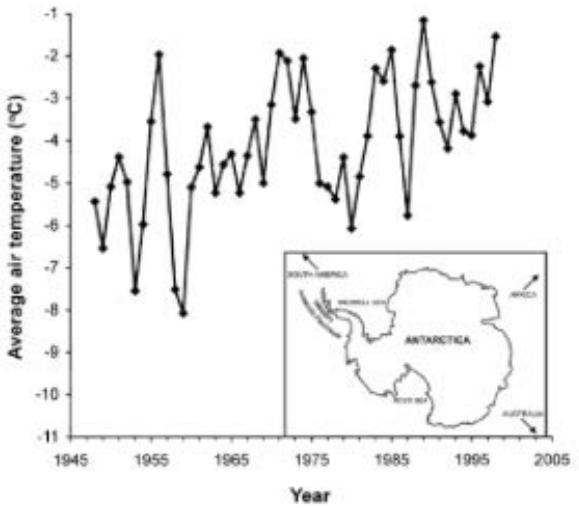
Warming Up To The Standards

Now you "Sea" Ice, Now You Don't



Warming Up To The Standards

Climatologists: Air temperature data set.



Source: Data compiled from the Palmer Station, Antarctica Long-Term Ecological Research (LTER) data archive. Data from the Palmer LTER archive were supported by the Office of Polar Programs, NSF Grants OPP-9011927, OPP-9632763, and OPP-021782.

Warming Up To The Standards

* Take a few minutes at your table to look over your group's specialist fact sheets.
* Use chart paper and markers to create a graph of the trends in the data set provided with your fact sheet.
* Get ready to discuss your group's graph and completed answers to the report sheet.
    * (10 minutes)

Warming Up To The Standards

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    * (10 minutes)

Warming Up To The Standards

Whole Group Presentations

Warming Up To The Standards

* Take your post-it notes and write out 6 cards:
* 1. Higher Air Temperature
* 2. Higher Winter Snow
* 3. Lower Krill Density
* 4. Higher Chinstrap Population
* 5. Lower Adelie Population
* 6. Lower Sea Ice Extent

Warming Up To The Standards

* Arrange your 6 notes in the form of a flow chart on your graph that shows the relationships between the variables. Discuss these with your table. *For example: if sea ice extent is lower, winter snow is higher.*

Warming Up To The Standards

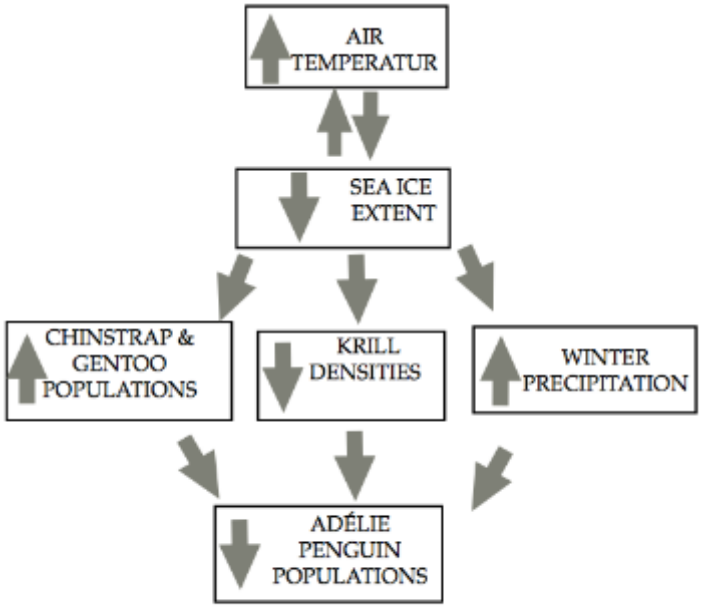

Figure 1: A flow chart (feedback cycle) demonstrating the impact of climate change on air temperature, sea ice extent, penguin and krill population densities and winter snow.

Warming Up To The Standards

Whole Group Discussion

* **Develop an argument based on evidence for what is happening in the Antarctic Peninsula.**
  * What is the most likely explanation for these changes?
  * Is there sufficient evidence to support your argument? Why/Why not? What else is needed?
  * Are there any explanations that are not likely based on the data you have?

Warming Up To The Standards

Whole Group Discussion

* **How does this activity illustrate the scientific process?**

* "...learning about science and engineering involves integration of the knowledge of scientific explanations (i.e., content knowledge) and the practices needed to engage in scientific inquiry and engineering design. Thus the framework seeks to illustrate how knowledge and practice must be intertwined in designing learning experiences in K–12 science education."

Warming Up To The Standards

ECOSYSTEMS: INTERACTIONS, ENERGY AND DYNAMICS

Performance Expectation	Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity, biodiversity and populations of ecosystems at different scales.
Clarification Statement	Emphasis is on quantitative analysis and comparison of the relationships among interdependent factors including boundaries, resources, climate and competition. Examples of mathematical comparisons could include graphs, charts, histograms, or population changes gathered from simulations or historical data sets.

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:** Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions (e.g. trigonometric, exponential and logarithmic) and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.	**INTERDEPENDENT RELATIONSHIPS IN ECOSYSTEMS** Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving resources and from such challenges as predation, competition, and disease that affect biodiversity, including genetic diversity within a population and species diversity within an ecosystem. Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem. (HS.LS2A.a) Human activity directly and indirectly affect biodiversity and ecosystem health (e.g., habitat fragmentation	**SCALE, PROPORTION, AND QUANTITY** The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs.

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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

So what are those conceptual shifts?

1. The new Louisiana Science Standards reflect how real science is done by intertwining three dimensions:
   * Scientific and engineering practices
   * Crosscutting concepts
   * Disciplinary Core Ideas
     * (more on these this afternoon!...much more!)

How will this benefit your students?

So what are those conceptual shifts?

2. The new Louisiana Science Standards integrate science, technology and engineering throughout grades K-12.

* Engineering design is raised to the same level as scientific inquiry.

How will this benefit your students?

So what are those conceptual shifts?

3 . The new Louisiana Science Standards build coherently from grades K-12.

* Opportunities to learn more complex ideas as students move through grade progression.
* Achievement of scientific literacy by focusing on fundamental developmentally appropriate content.

How will this benefit your students?

So what are those conceptual shifts?

4 . The new Louisiana Science Standards focus on depth of knowledge.

* Core ideas supported by facts rather than just facts!
* Gives students an organizational structure for knowledge acquisition.

How will this benefit your students?

So what are those conceptual shifts?

5. The new Louisiana Science Standards are Performance Expectations.

* Clearly stated goals of what students should know and be able to do.
* Each PE has a fully integrated set of Disciplinary Core Ideas, Crosscutting Concepts and Science and Engineering Practices.

How will this benefit your students?

Transitioning Through the Shift

* https://www.teachingchannel.org/videos/transition-to-ngss-achieve

From GLE"S to PE's

Where are they now?

Where are they now?

* Join a small group of teachers from your discipline for the next activity.
* Using a copy of the current GLE's and a "Louisiana Student Standards for Science" template compare the similarities and differences.
* Will you be teaching new material or just a new method?

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Curriculum Support and Timeline

- **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.

Professional Development Support and Timeline

Self-paced Learning

Live and recorded webinars on new standards - *June - July 2017*

- 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: 3-Dimensional Learning
- Monday, July 10 @ 9:00 a.m. - LSS Science Series Part 3: Learning Progressions
- Monday, July 17 @ 9:00 a.m. - LSS Science Series Part 4: Using Phenomenon to Engage Students in Learning
- Monday, July 24 @ 9:00 a.m. - LSS Science Series Part 5: Evaluating Science Tasks

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

Assessment Support and Timeline

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

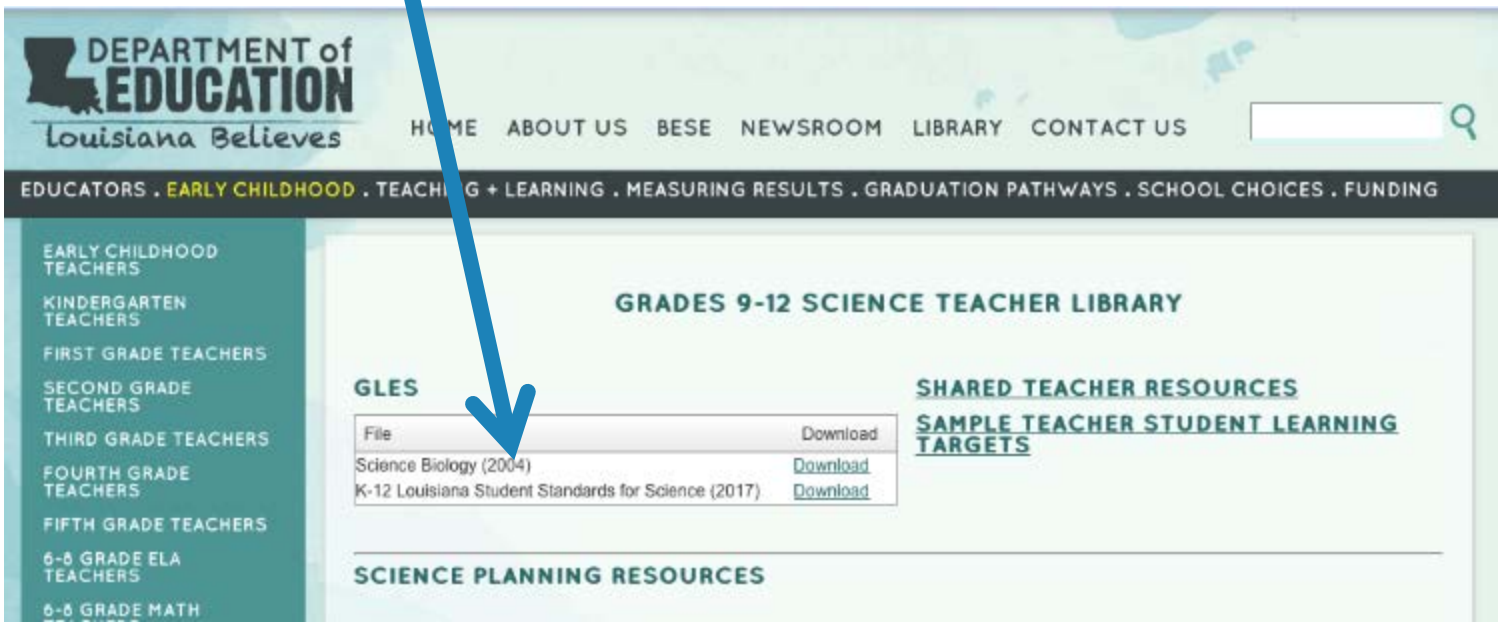
EAGLE Assessment Tool

- Teacher Leader Advisors, who will help create sample assessment items, hired and trained Summer 2017
- EAGLE items created throughout the 2017-2018 school year

Email assessment@la.gov with questions

Resources:

* K-12 Louisiana Student Standards for Science:
* https://www.louisianabelieves.com/resources/library/teacher-support-toolbox-library/9-12-grade-science-teachers



Resources:

* http://ngss.nsta.org/Classroom-Resources.aspx#aboutresources
*
* Use of Equip rubric to fully align existing lessons:
*
* http://nstahosted.org/pdfs/ngss/resources/EQuIPRubricForScienceOctober2014_0.pdf
*
* http://ngss.nsta.org/Resource.aspx?ResourceID=32
*
* http://ngss.nsta.org/Resource.aspx?ResourceID=448
*
* http://ngss.nsta.org/Resource.aspx?ResourceID=156
*

Resources:

* Introducing Teachers and Administrators to the NGSS. A professional Development Facilitator's Guide. Brunsell, E., Kneser, D., and Niemi, K. NSTA Press.2016

*

References:

* “Now You Sea Ice, Now You Don’t”
  * http://pal.lternet.edu/sites/default/files/files/Now%20you%20Sea%20Ice%20Now%20you%20Don%27t%20Low%20RES%20version.pdf

  * A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas. Published by National Research Council. ISBN 978-0-309-21441-4

Final Thoughts

Questions and Concerns