Pre Survey

http://tinyurl.com/PreIntro2015

Planning for New Science Standards
K-12 Introduction to
Three-Dimensional Learning

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June 11-12, 2015

Norms/Housekeeping

- Introductions
- Make yourself comfortable
- Links to websites *(also see Word doc on flashdrive):*

https://www.symbaloo.com/home/mix/arscience2015

- How well do you understand NGSS and 3-Dimensional Learning
- Padlet Poll: http://padlet.com/lesleymerritt68/K-12Intro

Goals: Planning for New Science Standards: K-12 Introduction to Three-Dimensional Learning

- Introduction to *A Framework for K-12 Science Education*
  - A Vision for K-12 Science Education
  - Three Dimensions of the Framework
- Introduction to Next Generation Science Standards (NGSS)
  - Architecture of the Standards
  - Implications for Classroom
- Arkansas K-12 Science Standards

Day 1 Objectives

- Examine the vision for K-12 Science Education in the 21st Century
- Connect science phenomena to the vision for K-12 Science Education
- Explore the three dimensions of "A Framework for K-12 Science Education"

Vision of The Framework
Think, Act, Do Like a Scientist

Observe phenomena for samples 1 and 2.

Use all senses except taste. Do not drink liquids.

Use goggles.

Safety Data Sheets

Observing Phenomena

Handout #2

- What do you observe about cups #1 and #2?
- Record observations of the phenomenon
- Draw a picture of what you think is happening
- Write an explanation of what you think is happening

"Talk to the Text" Strategy

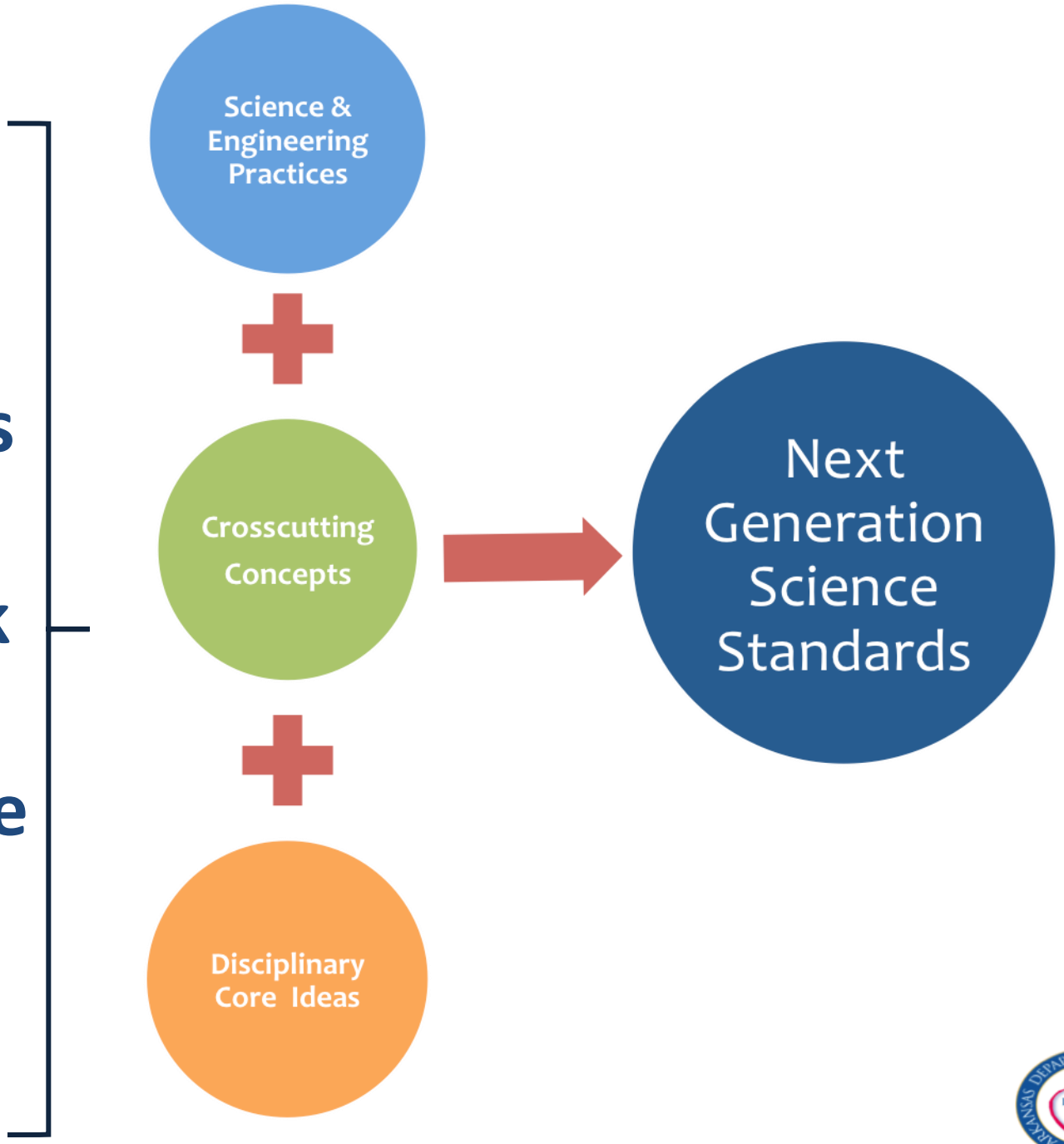
Handout #3

- Read the passage and think.
- Circle words or phrases you can identify.
- Add notes, questions, comments and predictions to margins.
- Think about connections, questions and additional information needed.

Pause--Reflect

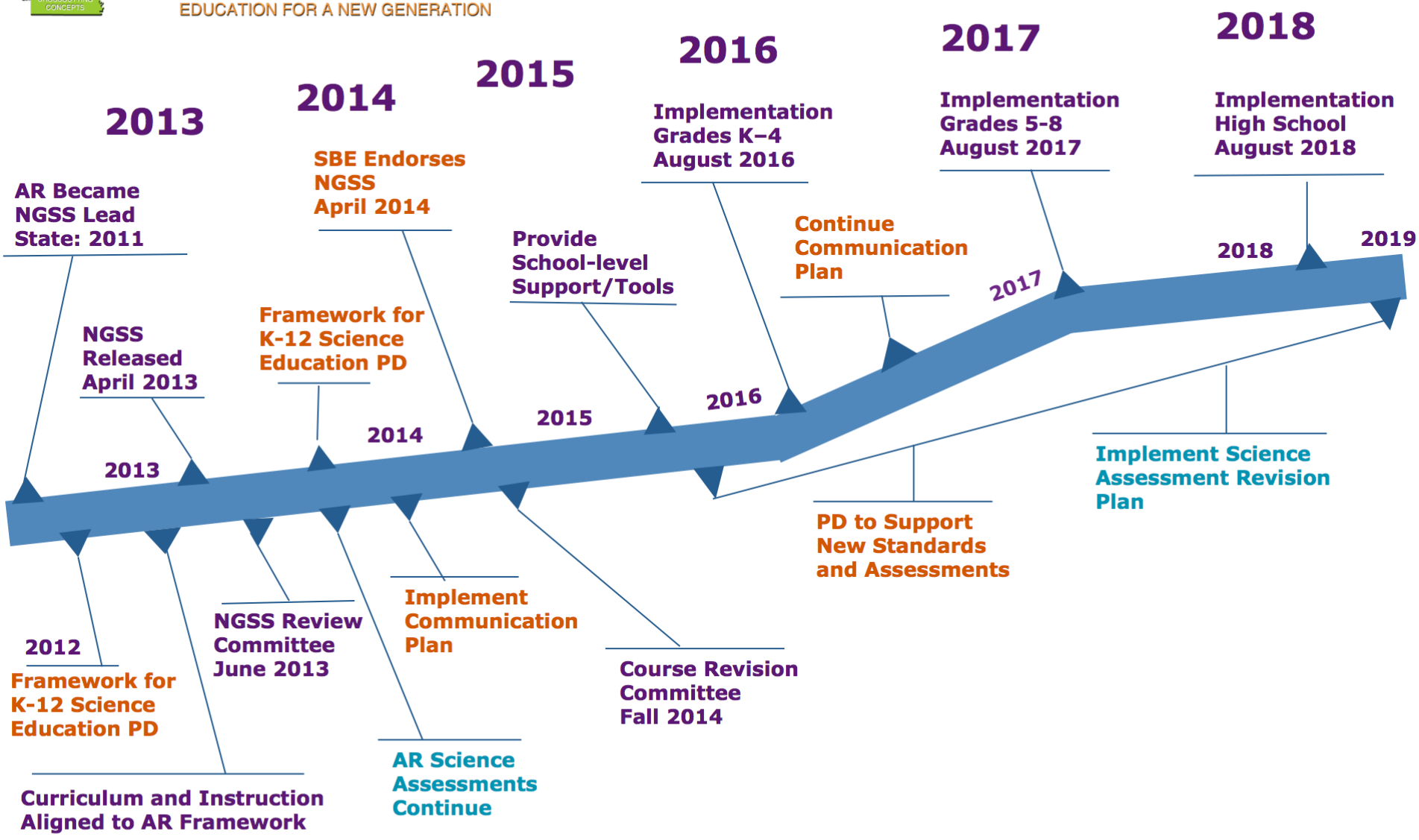
- Modify your drawing and explanation based on your reading.
- How has your thinking changed from your original drawing and explanation?
- What CCSS ELA language processes did you use?

Three Dimensions of the Framework for K-12 Science Education



ARKANSAS
K-12 SCIENCE STANDARDS
EDUCATION FOR A NEW GENERATION

Science Standards Timeline



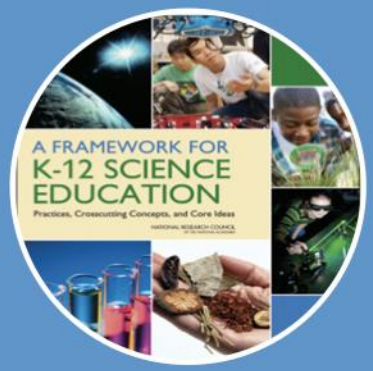
Curriculum and Instruction **Assessment** **Professional Development**

Next Steps in Arkansas

NGSS

Endorsed by SBE. AR K-12 Science Standards are being Written

Continue to teach the Arkansas Science Curriculum Framework

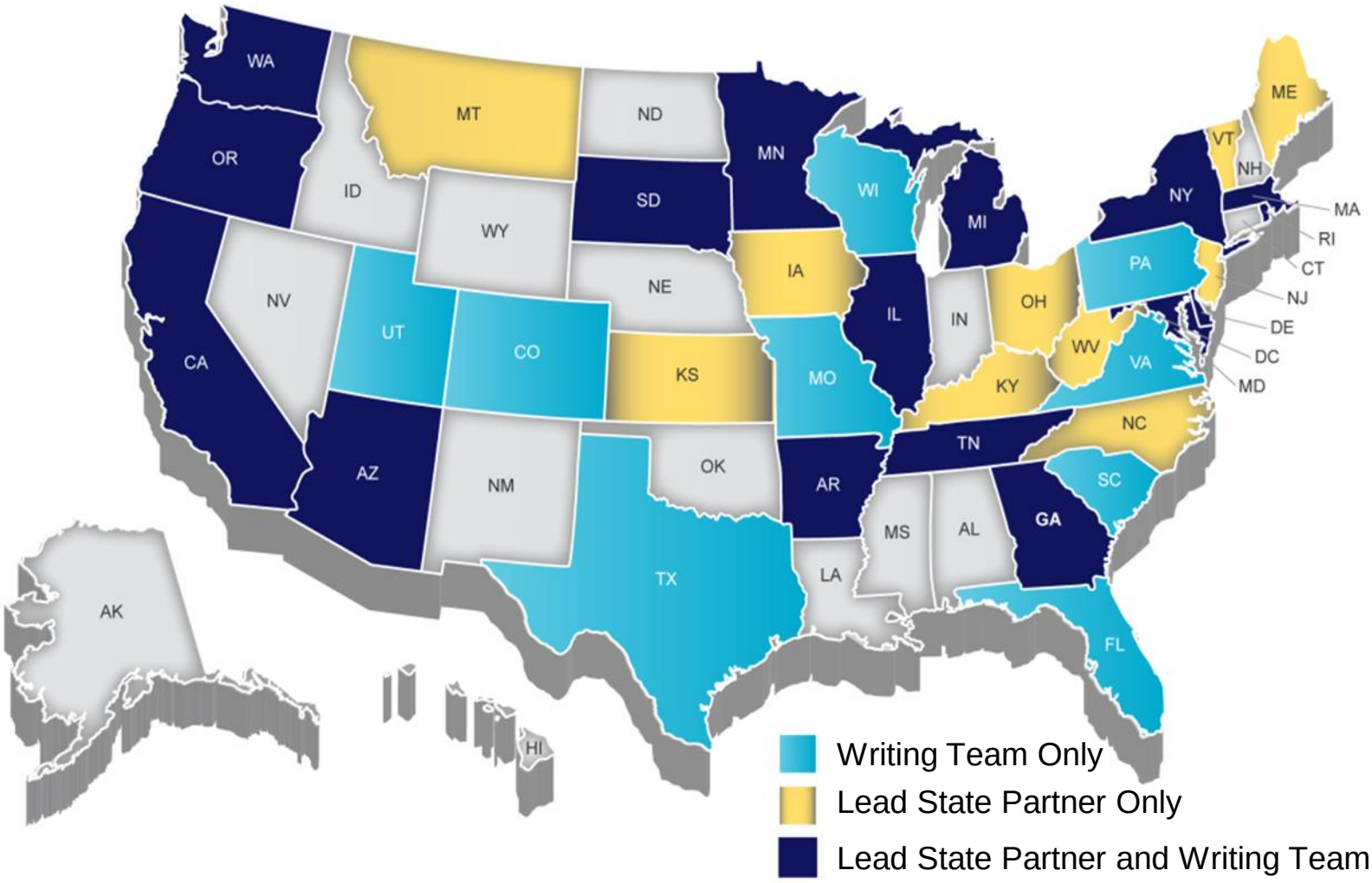


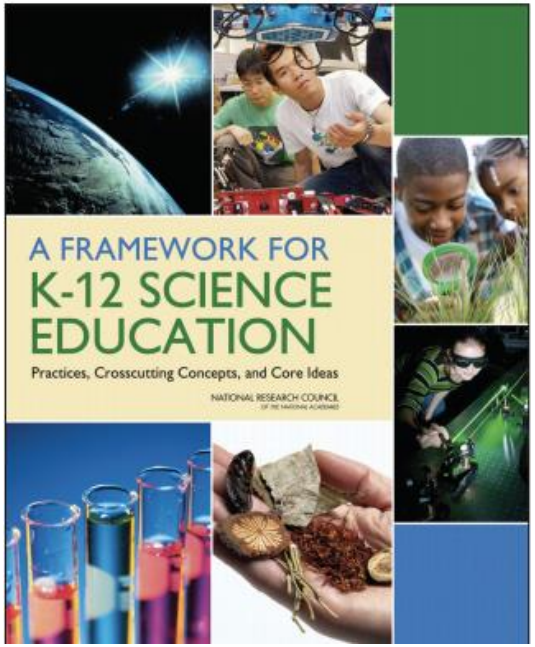
Become familiar with the Practices and Crosscutting Concepts

State-initiated PD and NGSS@NSTA

Begin to incorporate the Practices and Crosscutting Concepts into your curriculum

How was Arkansas Involved in the Development of the NGSS?





NEXT GENERATION SCIENCE STANDARDS

- Arkansas K-12 Science Standards
- Teacher support
- Instruction
- Curricula
- Assessment

Transitions in Science Education

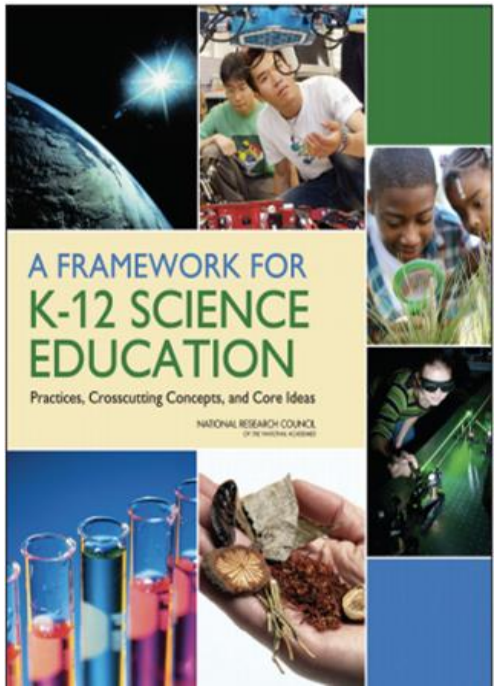
Arkansas K-12 Science Standards

Where are we NOW?

- Arkansas K-8 Science Standards are being presented to the State Board of Education TODAY!
- 9-12 Standards Committee is meeting this week to begin work on the standards.

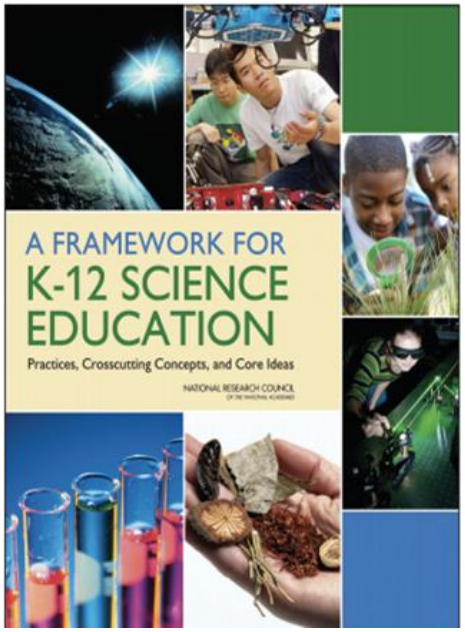
Students, over multiple years of school, actively engage in scientific and engineering practices and apply crosscutting concepts to deepen their understanding of the core ideas in these fields.

A Vision for K-12 Science Education



The main goal of the Framework is to ensure that by the end of high school all students have some appreciation of science, the ability to discuss and think critically about science-related issues, and the skills to pursue careers in science or engineering.

~Brian Reiser (2011)



Goals for K-12 Science Education

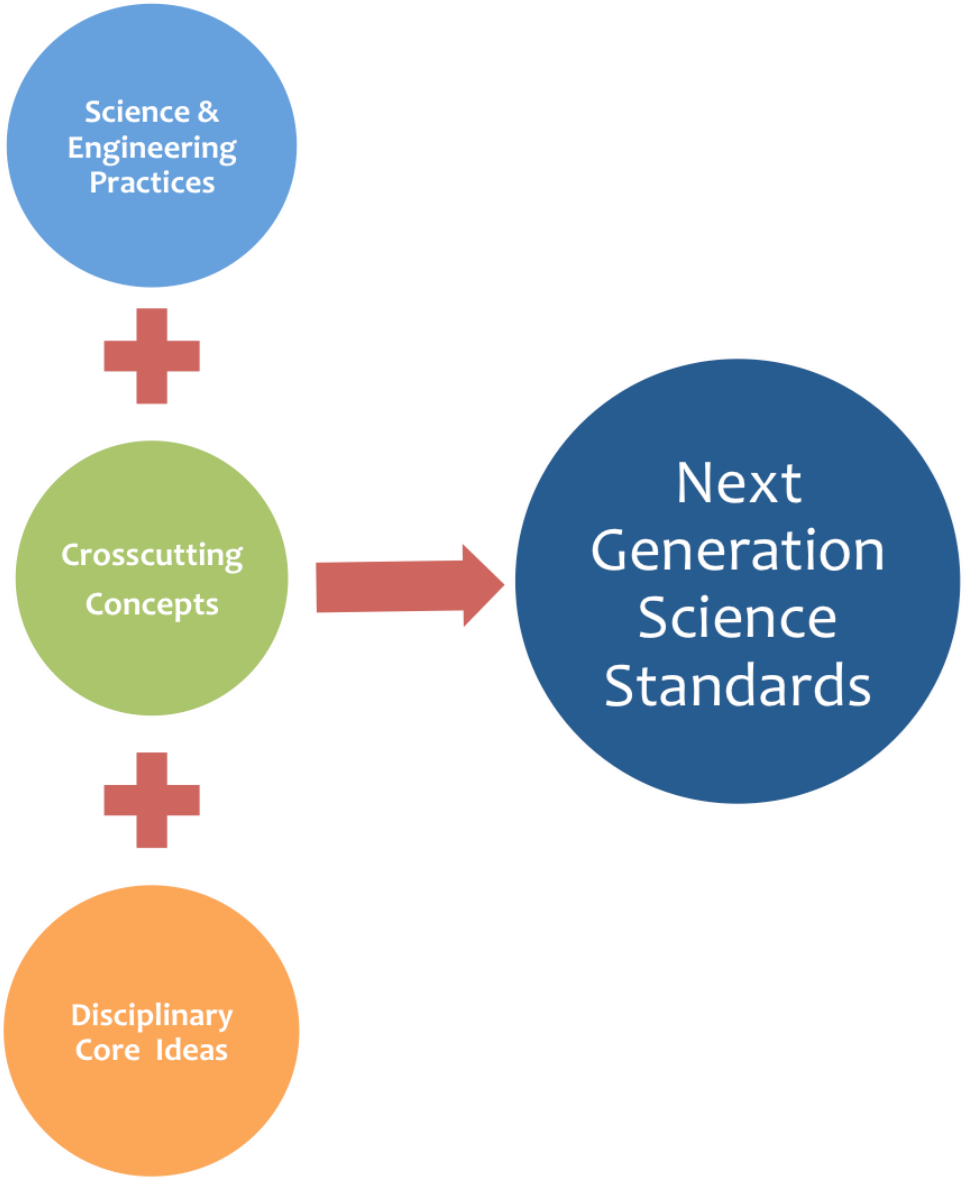
Guiding Assumptions and Organization of K-12 Framework

Read Chapter 2 of the Vision

(Handout #4)

Golden Line Strategy

Three Dimensions of the Framework for K-12 Science Education



NGSS OVERVIEW

Conceptual Shifts

Select a “shift” that you have worked with or have more questions about.

- Why did you chose the shift?
- What implications could the shift have for classroom practices?

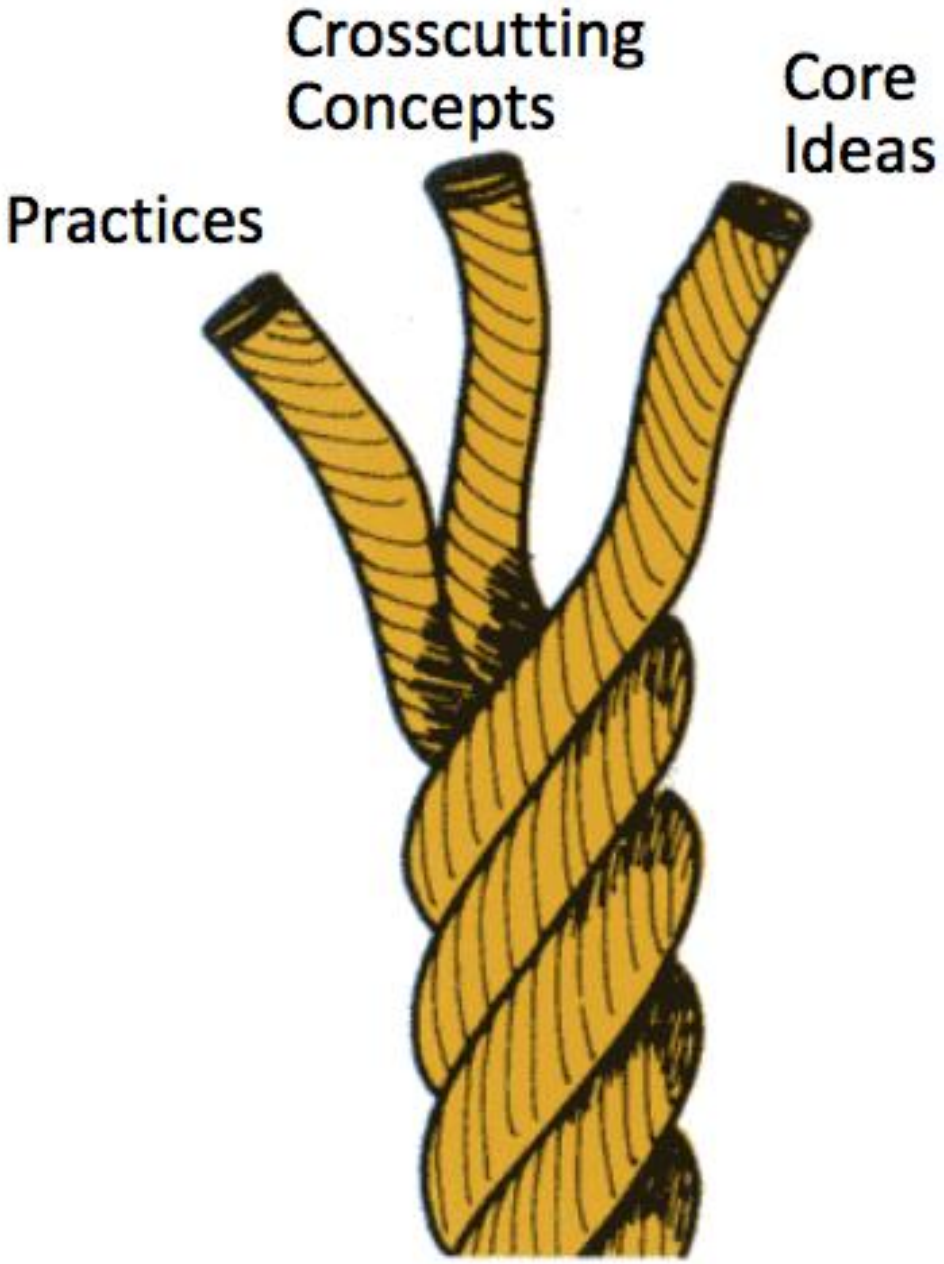
K-12 Framework Book Walk

- A Framework for K-12 Science Education Book Walk
  - http://tinyurl.com/p4mkzch

- Participants work in the 3 following Groups:
  - SEPs, CCCs, or DCIs

NGSS is Different

- Standards expressed as Performance Expectations.
- Combine core ideas, practices, and crosscutting concepts into a single statement of ***what is to be assessed***.
- Performance Expectations are not instructional strategies or objectives for a lesson.



What goes into a Performance Expectation aka Standard?

K-12 Core Ideas

- Physical Sciences
- Life Sciences
- Earth and Space Sciences
- Engineering, Technology, and Applications of Science

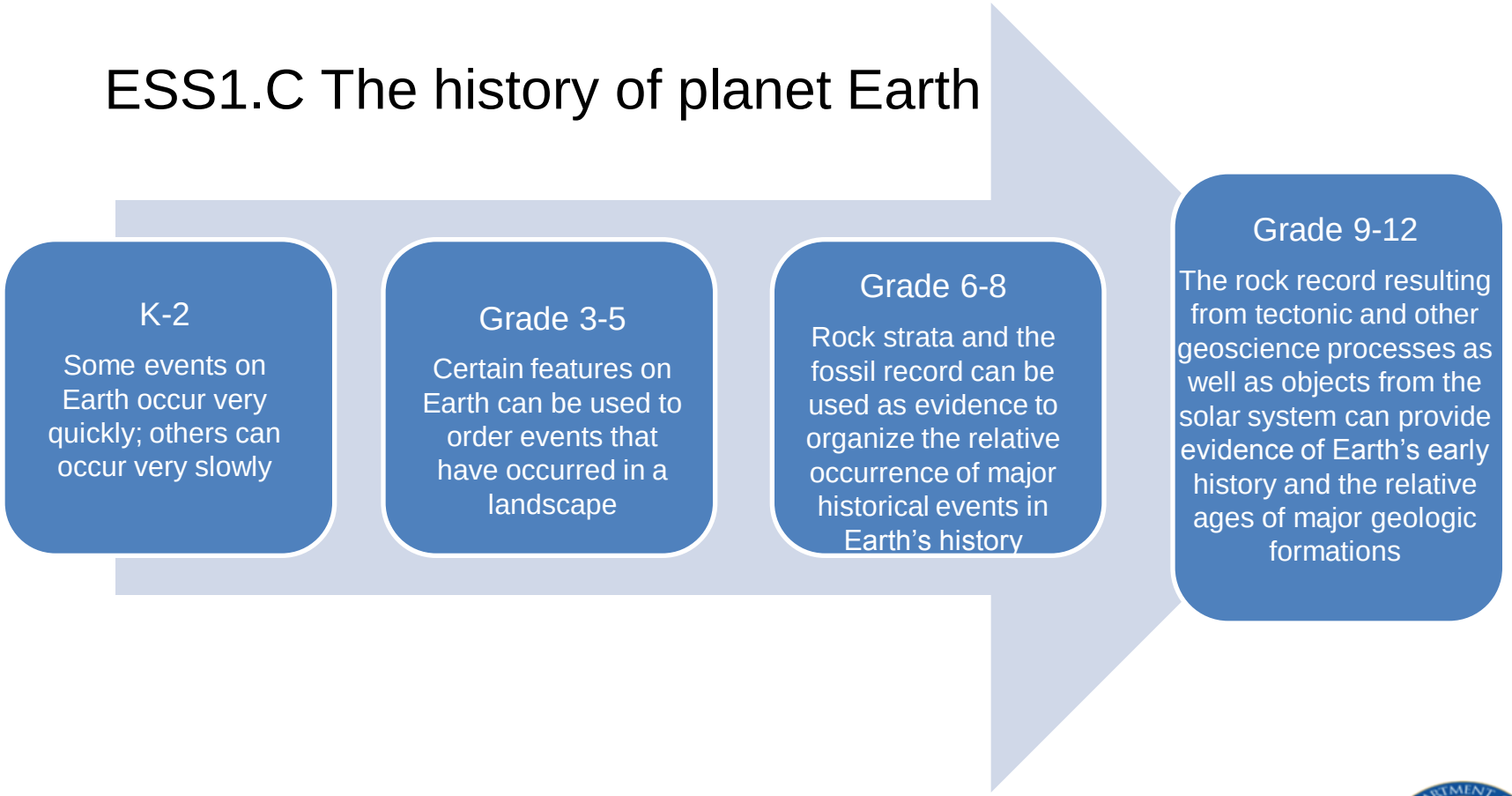
Arkansas K-12 Science Standards Matrix Organized by Disciplinary Core Ideas

		Life Science	Earth & Space Science	Physical Science	Engineering
Elementary School	K	K-LS1 From Molecules to Organisms: Structures and Processes	K-ESS2 Earth's Systems K-ESS3 Earth and Human Activity	K-PS2 Motion and Stability: Forces and Interactions K-PS3 Energy	
	1	1-LS1 From Molecules to Organisms: Structures and Processes 1-LS3 Heredity: Inheritance and Variation of Traits	1-ESS1 Earth's Place in the Universe	1-PS4 Waves and Their Applications in Technologies for Information Transfer	K-2-ETS1 Engineering Design
	2	2-LS2 Ecosystems: Interactions, Energy, and Dynamics 2-LS4 Biological Evolution: Unity and Diversity	2-ESS1 Earth's Place in the Universe 2-ESS2 Earth's Systems	2-PS1 Matter and Its Interactions	
	3	3-LS1 From Molecules to Organisms: Structures and Processes 3-LS2 Ecosystems: Interactions, Energy, and Dynamics 3-LS3 Heredity: Inheritance and Variation of Traits 3-LS4 Biological Evolution: Unity and Diversity	3-ESS2 Earth's Systems 3-ESS3 Earth and Human Activity	3-PS2 Motion and Stability: Forces and Interactions	
	4	4-LS1 From Molecules to Organisms: Structures and Processes	4-ESS1 Earth's Place in the Universe 4-ESS2 Earth's Systems 4-ESS3 Earth and Human Activity	4-PS3 Energy 4-PS4 Waves and Their Applications in Technologies for Information Transfer	3-5-ETS1 Engineering Design
	5	5-LS1 From Molecules to Organisms: Structures and Processes 5-LS2 Ecosystems: Interactions, Energy, and Dynamics	5-ESS1 Earth's Place in the Universe 5-ESS2 Earth's Systems 5-ESS3 Earth and Human Activity	5-PS1 Matter and Its Interactions 5-PS2 Motion and Stability: Forces and Interactions 5-PS3 Energy	
Middle School	6	6-LS1 From Molecules to Organisms: Structures and Processes 6-LS3 Heredity: Inheritance and Variation of Traits	6-ESS2 Earth's Systems 6-ESS3 Earth and Human Activity	6-PS3 Energy	
	7	7-LS1 From Molecules to Organisms: Structures and Processes 7-LS2 Ecosystems: Interactions, Energy, and Dynamics	7-ESS2 Earth's Systems 7-ESS3 Earth and Human Activity	7-PS1 Matter and Its Interactions	MS-ETS1 Engineering Design
	8	8-LS3 Heredity: Inheritance and Variation of Traits 8-LS4 Biological Evolution: Unity and Diversity	8-ESS1 Earth's Place in the Universe	8-PS2 Motion and Stability: Forces and Interactions 8-PS3 Energy 8-PS4 Waves and Their Applications in Technologies for Information Transfer	
High School		HS-LS1 From Molecules to Organisms: Structures and Processes HS-LS2 Ecosystems: Interactions, Energy, and Dynamics HS-LS3 Heredity: Inheritance and Variation of Traits HS-LS4 Biological Evolution: Unity and Diversity	HS-ESS1 Earth's Place in the Universe HS-ESS2 Earth's Systems HS-ESS3 Earth and Human Activity	HS-PS1 Matter and Its Interactions HS-PS2 Motion and Stability: Forces and Interactions HS-PS3 Energy HS-PS4 Waves and Their Applications in Technologies for Information Transfer	HS-ETS1 Engineering Design

This matrix from NSTA was modifed for Arkansas grade level standards May 2015

Learning Progression of Ideas Across Time

ESS1.C The history of planet Earth



Gots and Needs

On separate sticky notes, please provide the following:

- Something you **"got"** from today's session
- Something you **"need"** more information about

Day 2

ARKANSAS

K-12 SCIENCE STANDARDS

EDUCATION FOR A NEW GENERATION

NEXT GENERATION SCIENCE STANDARDS

ARKANSAS DEPARTMENT OF EDUCATION
LEADERSHIP SUPPORT SERVICE

Goals: Planning for New Science Standards: K-12 Introduction to Three-Dimensional Learning

- Introduction to *A Framework for K-12 Science Education*
  - A Vision for K-12 Science Education
  - 3 Dimensions of the Framework
- Introduction to Next Generation Science Standards (NGSS)
  - Architecture of the Standards
  - Implications for Classroom
- Arkansas K-12 Science Standards

Day 2 Objectives

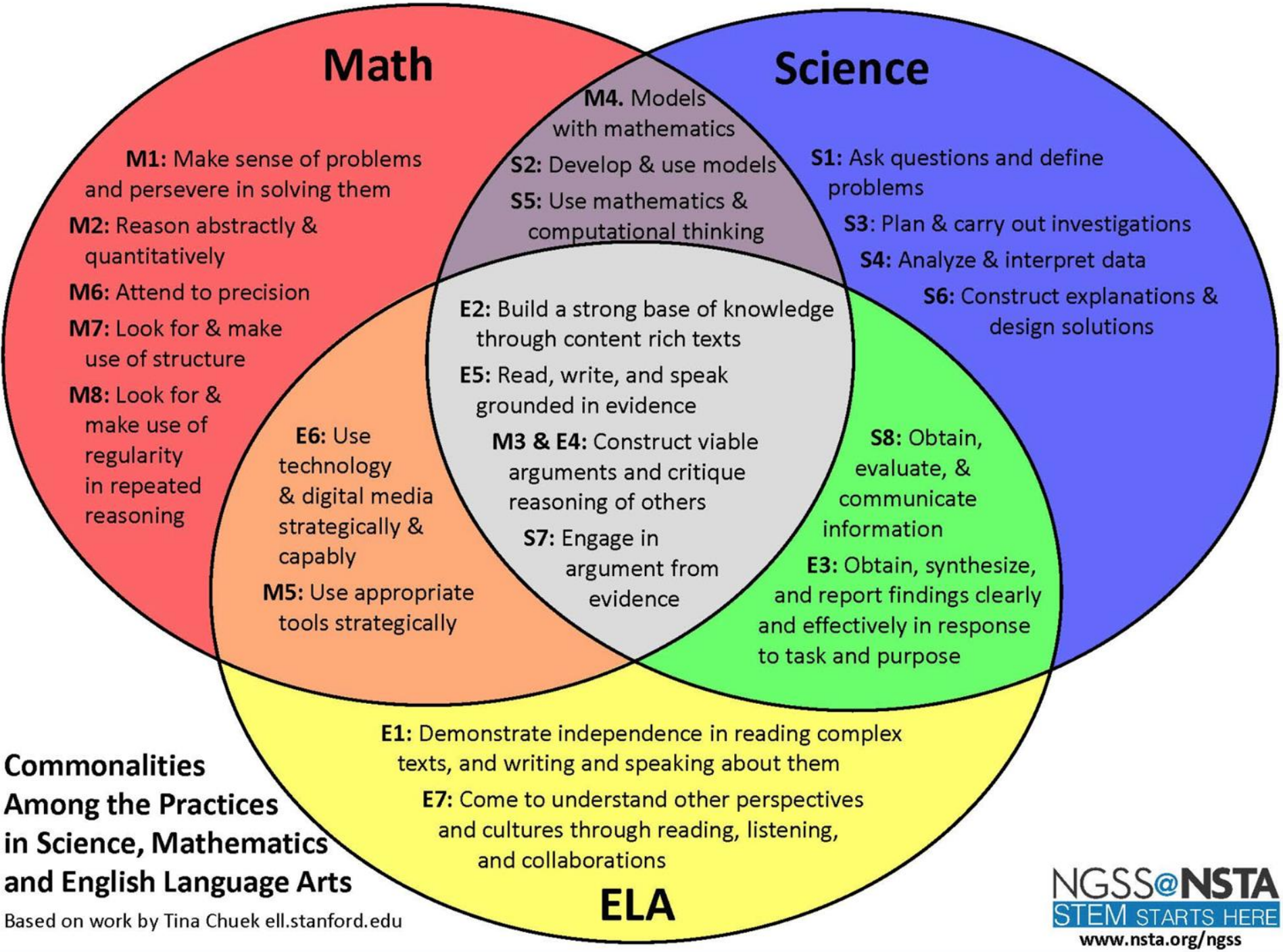
- Explore the Arkansas K-12 Science Standards and Website
- Consider Implications for Arkansas Classrooms
- Explore the Next Generation Science Standards Website
- Examine the architecture of the Arkansas Science Standards and NGSS

What indicates a Chemical Change?

Borrowed from Institute for Inquiry - Exploratorium

How Well Do You Know Your Practices?

CCSS ELA, CCSS Math, and NGSS Practices



Commonalities Among the Practices in Science, Mathematics and English Language Arts

Based on work by Tina Chuek ell.stanford.edu

NGSS@NSTA
STEM STARTS HERE
www.nsta.org/ngss

ELA/Math/Science

ELA Capacities	Mathematical Practices	Scientific and Engineering Practices
Demonstrate independence	Make sense of problems and persevere in solving them	Asking questions (for science) and defining problems (for engineering)
Build strong content knowledge	Reason abstractly and quantitatively	Developing and using models
Respond to the varying demands of audience, task, purpose, and discipline	Construct viable arguments and critique the reasoning of others	Planning and carrying out investigations
Comprehend as well as critique	Model with mathematics	Analyzing and interpreting data
Value evidence	Use appropriate tools strategically	Using mathematics, information and computer technology, and computational thinking
Use technology and digital media strategically and capably	Attend to precision	Constructing explanations (for science) and designing solutions (for engineering)
Come to understand other perspectives and cultures	Look for and make use of structure	Engaging in argument from evidence
	Look for and express regularity in repeated reasoning	Obtaining, evaluating, and communicating information

Science & Engineering Practices

Eight Practices

Note that in doing science or engineering, the practices are used iteratively and in combination; they are not linear steps to be taught in order.

Science & Engineering Practices

Eight Practices

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

Progression Appendix F: Asking Questions

Science and Engineering Practices	K–2 Condensed Practices	3–5 Condensed Practices	6–8 Condensed Practices	9–12 Condensed Practices
Asking Questions and Defining Problems A practice of science is to ask and refine questions that lead to descriptions and explanations of how the natural and designed world(s) works and which can be empirically tested. Engineering questions clarify problems to determine criteria for successful solutions and identify constraints to solve problems about the designed world. Both scientists and engineers also ask questions to clarify ideas.	Asking questions and defining problems in K–2 builds on prior experiences and progresses to simple descriptive questions that can be tested.	Asking questions and defining problems in 3–5 builds on K–2 experiences and progresses to specifying qualitative relationships.	Asking questions and defining problems in 6–8 builds on K–5 experiences and progresses to specifying relationships between variables, clarify arguments and models.	Asking questions and defining problems in 9–12 builds on K–8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations.
	• Ask questions based on observations to find more information about the natural and/or designed world(s).	• Ask questions about what would happen if a variable is changed.	• Ask questions ◦ that arise from careful observation of phenomena, models, or unexpected results, to clarify and/or seek additional information. ◦ to identify and/or clarify evidence and/or the premise(s) of an argument. ◦ to determine relationships between independent and dependent variables and relationships in models.. ◦ to clarify and/or refine a model, an explanation, or an engineering problem.	• Ask questions ◦ that arise from careful observation of phenomena, or unexpected results, to clarify and/or seek additional information. ◦ that arise from examining models or a theory, to clarify and/or seek additional information and relationships. ◦ to determine relationships, including quantitative relationships, between independent and dependent variables. ◦ to clarify and refine a model, an explanation, or an engineering problem.
	• Ask and/or identify questions that can be answered by an investigation.	• Identify scientific (testable) and non-scientific (non-testable) questions. • Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships.	• Ask questions that require sufficient and appropriate empirical evidence to answer. • Ask questions that can be investigated within the scope of the classroom, outdoor environment, and museums and other public facilities with available resources and, when appropriate, frame a hypothesis based on observations and scientific principles.	• Evaluate a question to determine if it is testable and relevant. • Ask questions that can be investigated within the scope of the school laboratory, research facilities, or field (e.g., outdoor environment) with available resources and, when appropriate, frame a hypothesis based on a model or theory.
			• Ask questions that challenge the premise(s) of an argument or the interpretation of a data set.	• Ask and/or evaluate questions that challenge the premise(s) of an argument, the interpretation of a data set, or the suitability of

Crosscutting Concepts

Seven Crosscutting Concepts Appendix G

1. Patterns
2. Cause and effect: Mechanism and explanation
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

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Using Crosscutting Concepts

Across Disciplines

Life	Earth	Physical
Photosynthesis	Earthquakes	Electricity
←	ENERGY	→

Within a Discipline

	Life Science	
Cells	Organ Systems	Ecosystems
	SCALE	
←		→


Science and Engineering Practices
Disciplinary Core Ideas
Crosscutting Concepts
NEXT GENERATION
SCIENCE
STANDARDS

Three-Dimensional Learning

7-LS2-1 Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem

Three-Dimensional Learning Dissected

7-LS2-1 Analyze and interpret data to provide evidence for

the effects of

resource availability on organisms and populations of organisms in an ecosystem.

How to Read NGSS Standards

- http://nextgenscience.org/how-to-read-the-standards

How to Read Arkansas Standards

(Handout #7-A)

Performance Expectation

2.Structure and Properties of Matter

Students who demonstrate understanding can:

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 properties is limited to number or length.]

Foundation Boxes

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

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)

Disciplinary Core Ideas

PS1.A: Structure and Properties of Matter

- Different properties are suited to different purposes. (2-PS1-2)

Crosscutting Concepts

Cause and Effect

- Simple tests can be designed to gather evidence to support or refute student ideas about causes. (2-PS1-2)

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 by using natural materials. (2-PS1-2)

Connection Boxes

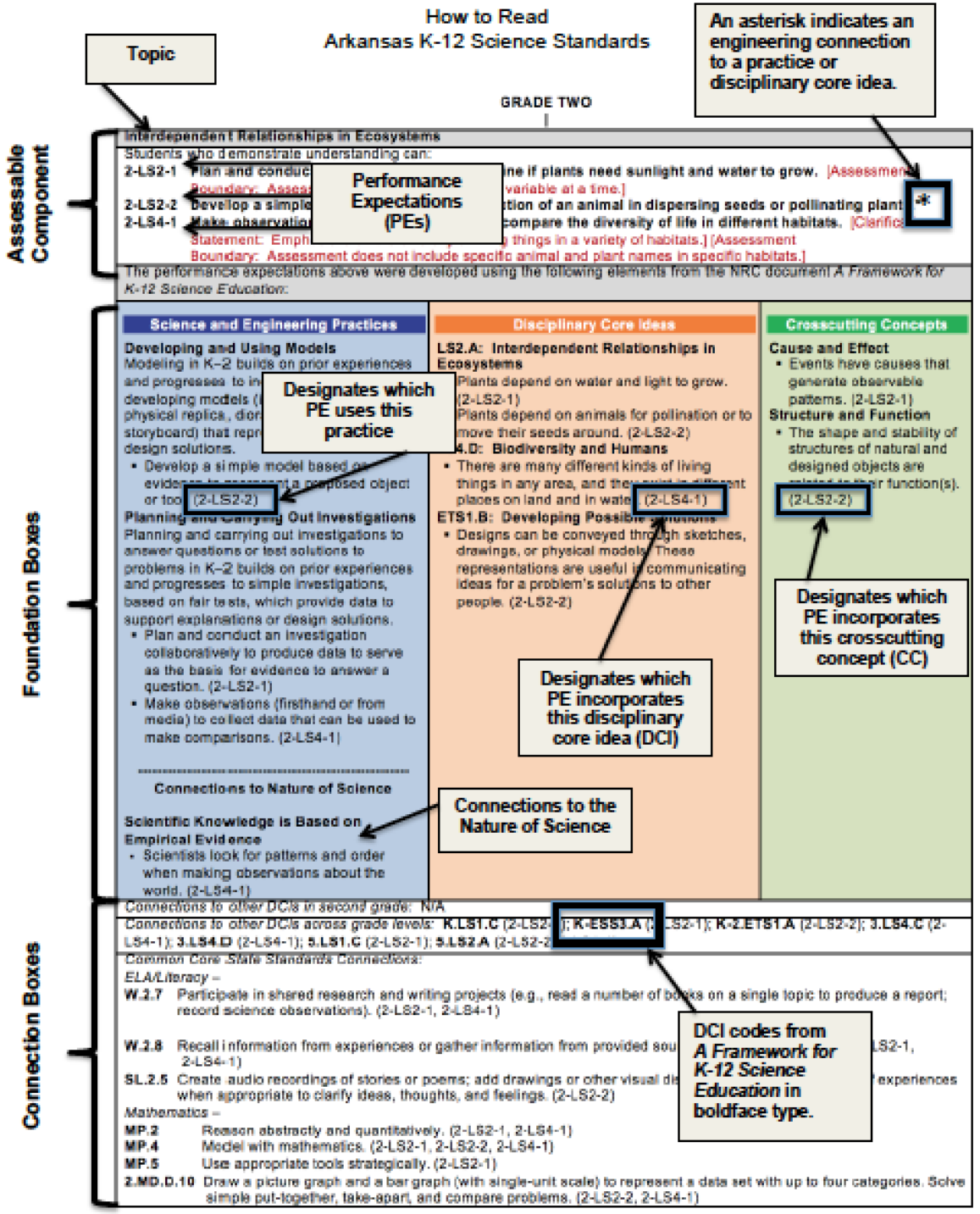
Connections to other DCIs in this grade-level: will be available on or before April 26, 2013.

Articulation of DCIs across grade-levels: will be available on or before April 26, 2013.

Common Core State Standards Connections: will be available on or before April 26, 2013.

ELA/Literacy –

Mathematics –


How to Read
Arkansas K-12 Science Standards
Topic
An asterisk indicates an engineering connection to a practice or disciplinary core idea.
GRADE TWO
Assessable Component
Performance Expectations (PEs)
Foundation Boxes
Science and Engineering Practices
Disciplinary Core Ideas
Crosscutting Concepts
Designates which PE uses this practice
Designates which PE incorporates this disciplinary core idea (DCI)
Designates which PE incorporates this crosscutting concept (CC)
Connections to the Nature of Science
Connection Boxes
DCI codes from A Framework for K-12 Science Education in boldface type.

NGSS Dissection Task

Identify and Highlight the

- Practice in the PE in blue
- DCI in the PE in orange
- CCC in the PE in green

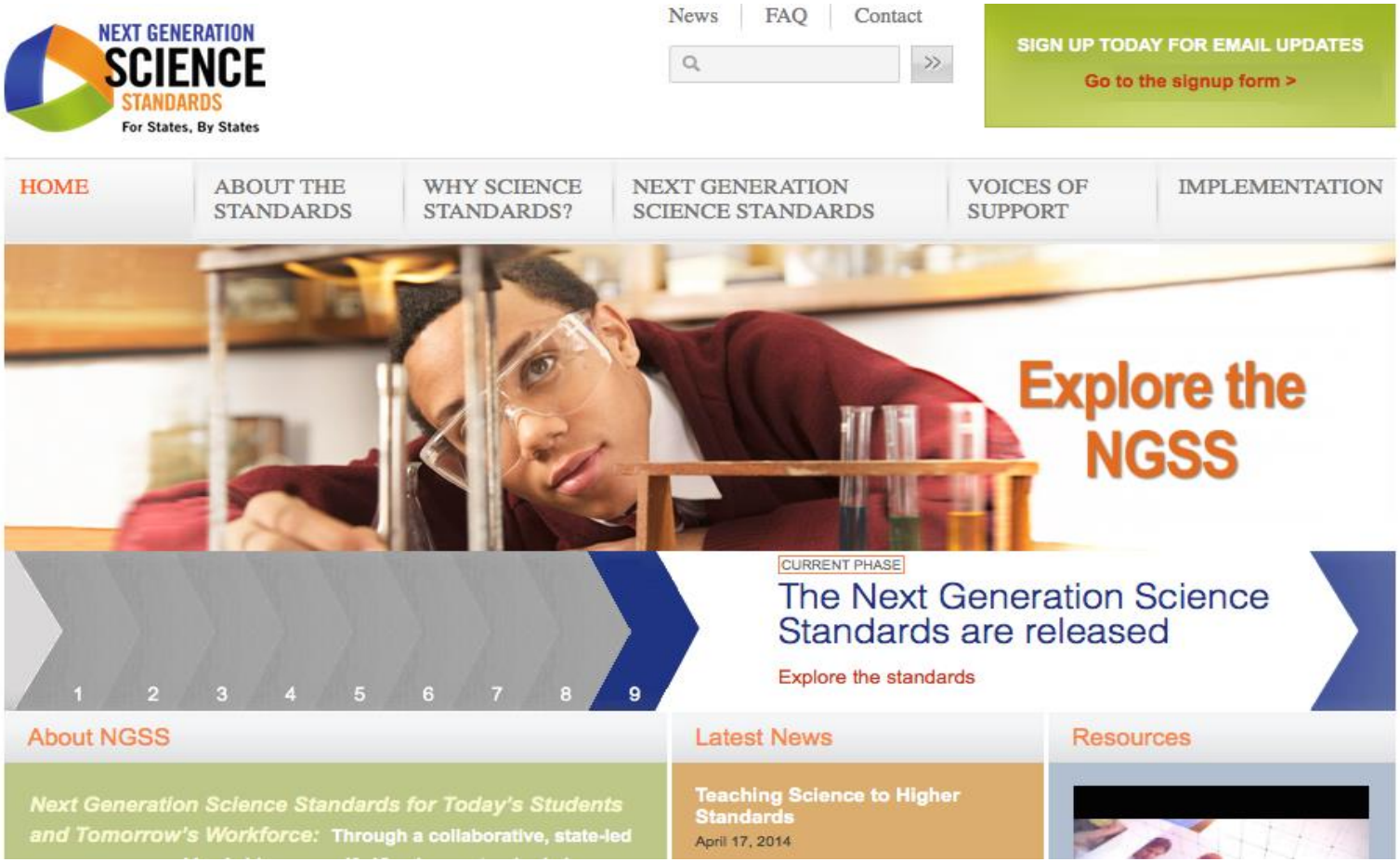
Identify and Underline the

- Clarification statement

Identify and Circle

- Assessment Boundary

http://www.nextgenscience.org/



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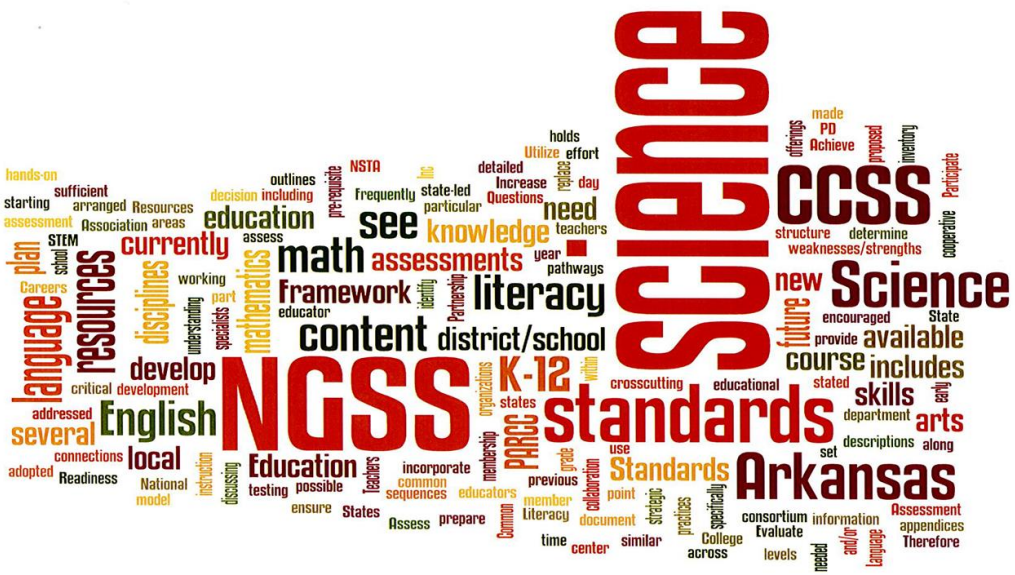
EDUCATION FOR A NEW GENERATION

http://www.arkansased.org/

Transition Activity

Ice Breaker



Find a partner

Stand face-to-face

ADE Contact Information

Science Curriculum and Instruction

Michele.Snyder@arkansas.gov

Science Professional Development

Catherine.Mackey@arkansas.gov

Science Assessment

Ann.Finch@arkansas.gov

Post Survey

http://tinyurl.com/PostIntro2015

Drag slides below to archive for future reference

END

Slides below may/may not be needed.