



MATHEMATICS & SCIENCE UPDATES

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Missouri Department of Elementary
and Secondary Education

Top 10 by 20

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- Goal #1
 - All Missouri students will graduate college and career ready.
- Goal #2
 - All Missouri children will enter kindergarten prepared to be successful in school.
- Goal #3
 - Missouri will prepare, develop and support effective educators.
- Goal #4
 - DESE will improve department efficiency and operational effectiveness.

Building Math & Science Capacity

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- Elementary Math Specialist (EMS)
- Content Specific Professional Learning
 - Presidential Award for Excellence in Mathematics and Science Teaching (PAEMST)
 - Interface
 - Regional, State and National Math Organizations

Why are we here today?

Why are we here today?

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Why are we here today?

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Why Change

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Which fraction has a value closest to $\frac{1}{2}$?



Nationally	25%	6%	41%	26%
Missouri	20%	6%	44%	28%

4th Grade, NAEP 2009
Released Item

Implementation Schedule

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2015-2016	2016-2017	2017-2018	2018-2019	2019-2020
English Language Arts & Mathematics		English Language Arts & Mathematics		
Science			Science	
Social Studies				Social Studies



Assessments Aligned to the Previous Expectations

Assessments Aligned to the New Expectations

New Assessment Development

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Each step in the process involves recruited groups of Missouri educators.

- Performance Level Descriptors
- Blueprints
- Item Development
- Content and Bias Review
- Performance Level Setting

HB 1490 - History

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□ Timeline

- Legislation passed and signed Summer 2014
- Committees met October 2014 – October 2015
- Committee Submissions October 2015
- Public Comment Period November 2nd – December 2nd
- Legislative Education Committee November 2nd – December 2nd
- Educational Researchers November 2nd – January 13th
- State Board Review January, February & March 2016
- Additional Public Comments February 17th – March 4th
- State Board Vote April 2016 All Approved

Missouri Learning Standards (MLS)

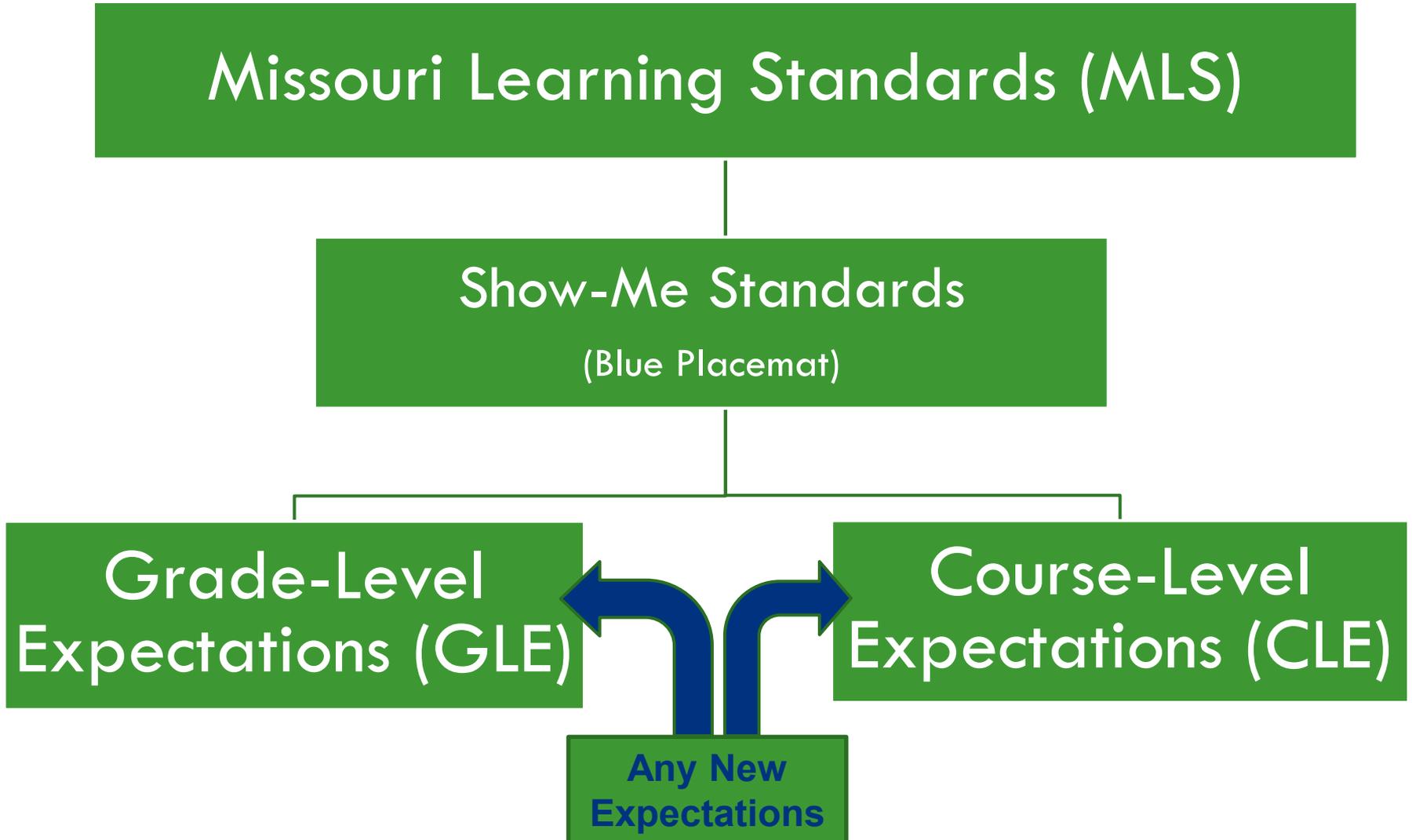
Missouri Learning Standards (MLS)

Show-Me Standards
(Blue Placemat)

Grade-Level
Expectations (GLE)

Course-Level
Expectations (CLE)

Any New
Expectations



Curriculum Section

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- Assessment and Standards Administrator Lisa Sireno
 - Fine Arts – Tom Tobias (573-751-9610)
 - Social Studies – Dixie Grupe (573-751-0398)
 - Dyslexia – Kim Stuckey (573-751-2584)
 - English Language Arts – Debbie Jameson (573-751-4898)
 - Science – John Kitchens (573-751-9610)
 - English Language Learners – Ryan Rumpf (573-751-3926)
 - Mathematics (573-751-1395)
- 573-522-4003 -or- curriculum@dese.mo.gov

Assessment Section

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- Assessment and Standards Administrator – Lisa Sireno
 - Director of Assessment – Shaun Bates (573-751-2857)
 - Assist. Director of Assessment – Drew Linkon (573-751-8285)
 - English Language Learners (ELL), SPED, Quality Assurance (QA)
 - Assist. Director of Assessment – Joan Jarrett (573-751-1488)
 - ACT®, End-Of-Course (EOC)
 - Assist. Director of Assessment – Steve Schellman (573-751-4295)
 - Grade-Level-Assessment (GLA)
 - Assist. Director of Assessment – Caryn Giarratano (573-751-6731)
 - Dynamic Learning Map (DLM) – MAP-A
 - 573-751-3545 or assessment@dese.mo.gov

The New Expectations - Overview

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- Documents
 - Expectations
 - Crosswalks
- DESE Professional Learning Series
 - 5th Summer Cohort
 - Regional Meetings
 - <http://dese.mo.gov/college-career-readiness/curriculum>

Mathematics Coding

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- 5.NBT.A.1 Read , write and identify numbers...
 - Grade/Course Level: (Grade 5)
 - Domain: (Number Sense and Operations in Base Ten (NBT))
 - Cluster: (A)
 - Expectation: (1)
- The Expectations are not...
 - Chronological
 - Curriculum

Mathematics Coding

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★ CLUSTER
HEADING

★ Grade 5 Grade-Level Expectations

★ DOMAIN

NUMBER SENSE AND OPERATIONS IN BASE TEN: NBT

5.NBT.A

Use place value system understanding to perform operations with multi-digit whole numbers to billions and decimals to thousandths.

5.NBT.A.1

Read, write and identify numbers from billions to thousandths using number names, base ten numerals and expanded form.

5.NBT.A.2

Compare two numbers from billions to thousandths using the symbols $>$, $=$ or $<$, and justify the solution.

5.NBT.A.3

Understand that in a multi-digit number, a digit represents $1/10$ times what it would represent in the place to its left.

5.NBT.A.4

Evaluate the value of powers of 10 and understand the relationship to the place value system.

5.NBT.A.5

Round numbers from billions to thousandths place.

5.NBT.A.6

Add and subtract multi-digit whole numbers and decimals to the thousandths place, and justify the solution.

★ CLUSTER

★ EXPECTATION

Mathematics Crosswalks

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<p>A1.REI.C.6</p>	<p>Explain that the graph of an equation in two variables is the set of all its solutions plotted in the Cartesian coordinate plane.</p>	<p>HSA-REI.D.10</p>	<p>Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane (e.g., a line).</p>
		<p>HSA-REI.D.11</p>	<p>Explain why the x-coordinates of the points where the graphs of $y = f(x)$ and $y = g(x)$ intersect are the solutions to the equation $f(x) = g(x)$. Solve systems of equations approximately, e.g., using technology; or find exact solutions for systems of equations when the functions are linear, polynomial, rational, logarithmic, exponential, and/or trigonometric.</p>
<p>A1.REI.C.7</p>	<p>Graph the solution to a linear inequality in two variables.</p>		<p>Graph the solution to a linear inequality in two variables.</p>
<p>A1.REI.C.8</p>	<p>Solve problems involving a system of linear inequalities.</p>	<p>HSA-REI.D.12</p>	<p>Solve systems of linear inequalities approximately, e.g., using technology; or find exact solutions for systems of linear inequalities when the functions are linear.</p>
<p>A1.APR.A</p>	<p>Perform operations on polynomials.</p>		
<p>A1.APR.A.1</p>	<p>Add, subtract and multiply polynomials, and understand that polynomials follow the same general rules of arithmetic and are closed under these operations.</p>	<p>HSA-APR.A.1</p>	<p>Understand that polynomials form a system that is closed under addition, subtraction, and multiplication; add, subtract, and multiply polynomials.</p>
<p>A1.APR.A.2</p>	<p>Divide polynomials by monomials.</p>		
<p>A1.IF.A</p>	<p>Understand the concept of a function and use function notation.</p>		

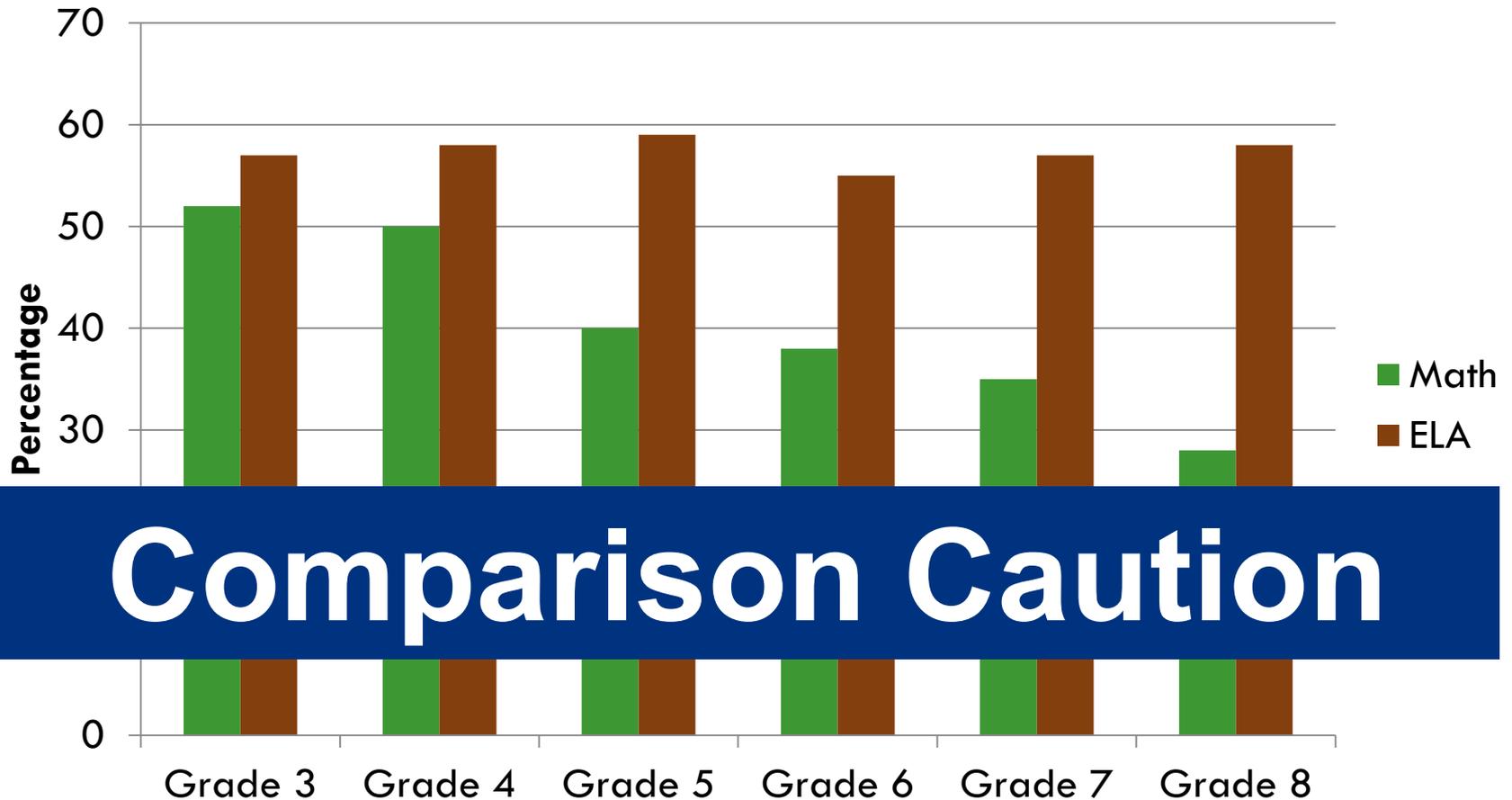
Mathematics Assessments

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- Grade-Level-Assessments (GLAs)
 - Grades 3-8 (required)
- End-of-Course (EOC) Assessments
 - Algebra 1 (required)
 - Geometry (optional)
 - Algebra 2 (optional – required for some)
- New Assessments in 2017-2018
- ACT[®] (2 years of data)

Comparison Caution

2015 Proficient + Advanced



Comparison Caution

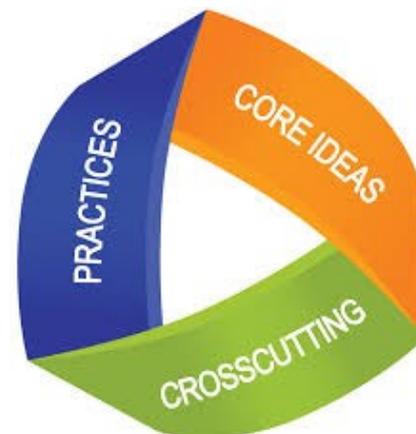
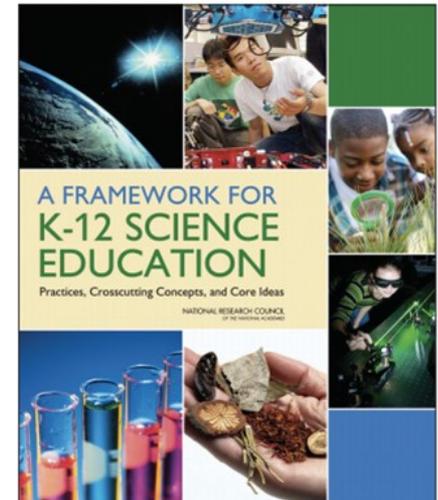
Science: MLS

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□ Paradigm Shift

□ How many are familiar with:

- “A Framework for K – 12 Science Education”
- 3-Dimensional Learning Model



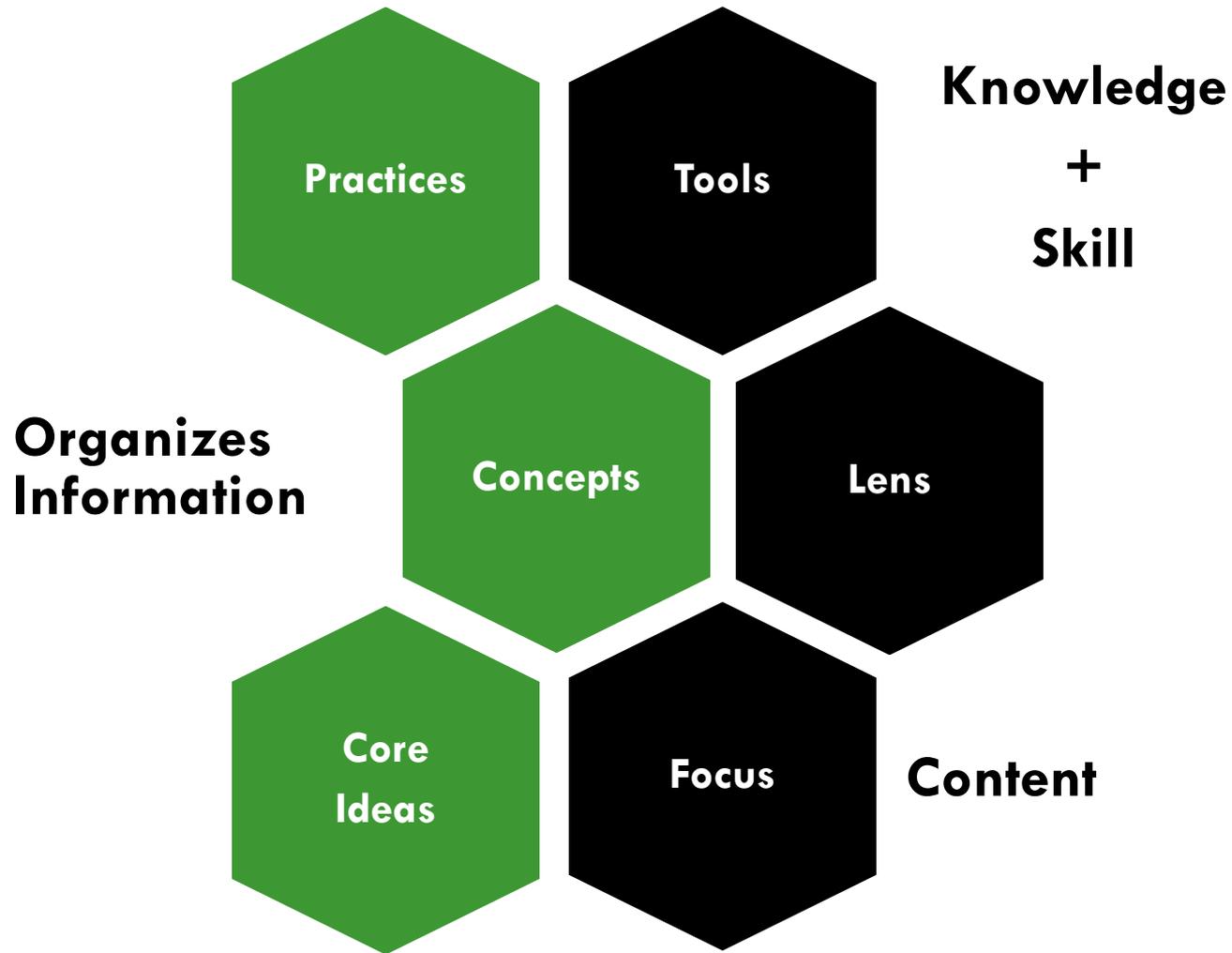
Science: 3-Dimensional Model

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- Practices
 - Scientific inquiry vs. engineering design
 - 8 Practices applying to both Science and Engineering
- Concepts
 - Themes repeated throughout science and engineering
 - Apply to other disciplines as well
- Core Ideas
 - Practices and Concepts are the platform for Content
 - The phenomena to be investigated

Science: 3 Dimensions in Action

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New Expectations in the Classroom

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More

- Student investigation
- Students gather information from multiple sources and summarizing
- Student journals, posters, reports, presentations with evidence and explanations

Less/Fewer

- Teacher providing info
- Student reading textbooks and answering questions at the end of chapters
- Worksheets

Science: Coding

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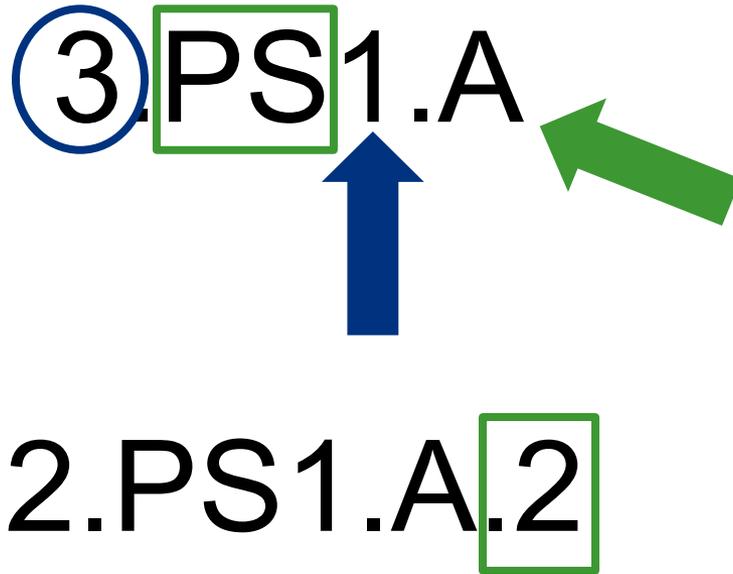
Grade

Strand

Core Idea

Component Idea

Expectation



Science: Crosswalks

<p>6-8.PS2.A.1</p>	<p>Apply physics principles to design a solution that minimizes the force of an object during a collision and develop an evaluation of the solution.</p>	<p>FM.2.A.7</p>	<p>a. Ic mot of f b. C me:</p>
<p>6-8.PS2.A.2</p>	<p>Plan and conduct an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object. [Clarification Statement: Emphasis is on balanced (Newton's First Law) and unbalanced forces in a system, qualitative comparisons of forces, mass and changes in motion (Newton's Second Law), frame of</p>	<p>FM.2.D.7</p>	<p>a. C mag b. E pus rem c. E</p>
<p>6-8.PS2.B.1</p>	<p>Analyze diagrams and collect data to determine the factors that affect the strength of electric and magnetic forces. [Clarification Statement: Examples of devices that use electric and magnetic forces could include electromagnets, electric motors, or generators. Examples of data could include the effect of the number of turns of wire on the strength of an electromagnet, or the effect of increasing the number or strength of magnets on the speed of an electric motor.]</p>	<p>ME.2.A.7</p>	<p>h. Describe the interactions (i.e., repel, attract) of like and unlike charges (i.e., magnetic, static electric, electrical) i. Diagram and identify a complete electric circuit by using a source (battery), means of transfer (wires), and receiver (resistance bulbs, motors, fans) j. Observe and describe the evidence of energy transfer in a closed series circuit k. Describe the effects of resistance (number of receivers), amount of voltage (number of energy sources), and kind of transfer materials on the current being transferred through a circuit (e.g., brightness of light, speed of motor) l. Classify materials as conductors or insulators of electricity when placed within a circuit (e.g., wood, pencil lead, plastic, glass, aluminum foil, lemon juice, air, water)</p>

Science: Crosswalks

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6-8.PS4.A.2	<p>Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials. [Clarification Statement: Emphasis is on both light and mechanical waves. Examples of models could include drawings, simulations, and written descriptions.]</p>	ME.2.A.6	a. Identify sources of visible light (e.g., the Sun and other stars, flint, bulb, flames, lightning)
			b. Describe evidence (i.e., cannot bend around walls) that visible light travels in a straight line, using the appropriate tools (i.e., pinhole viewer, ray box, laser pointer)
			c. Compare the reflection of visible light by various surfaces (i.e., mirror, smooth and rough surfaces, shiny and dull surfaces, Moon)
			d. Compare the refraction of visible light passing through different transparent and translucent materials (e.g., prisms, water, a lens)
			e. Predict how different surfaces (transparent, translucent, opaque) and lenses (convex, concave) affect the behavior of visible light rays and the resulting image of an object
			f. Identify receivers of visible light energy (e.g., eye, photocell)
			g. Recognize and explain that an object is "seen" only when the object emits or reflects light to the eye
			h. Recognize differences in wavelength and energy levels within that range of visible light that can be seen by the human eye are perceived as differences in color
			i. Describe how sound energy is transferred by wave-like disturbances that spread away from the source through a medium
			k. Predict how the properties of the medium (e.g., air, water, empty space, rock) affect the speed of different types of mechanical waves (i.e., earthquake, sound)
			j. Describe how sound energy is transferred by wave-like disturbances that spread away from the source through a medium
			j. Describe how changes in energy cause changes in loudness and pitch of a sound
			k. Predict how the properties of the medium (e.g., air, water, empty space, rock) affect the speed of different types of mechanical waves (i.e., earthquake, sound)
		ME.2.C.6	a. Recognize and describe how energy from the Sun is transferred to Earth in a range of wavelengths and energy levels, including visible light, infrared radiation, and ultraviolet radiation

Science: Assessments

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- Current Expectations
 - Grade-Level-Assessments (GLAs)
 - Grade 5 (required)
 - Grade 8 (required)
 - End-of-Course (EOC) Assessments
 - Physical Science (optional)
 - Biology (required)
- Plan for the New Expectations
 - New expectations to be assessed in the 2018-2019 school year
- ACT[®] (2 years of data)

Discussion Items For Districts

- Determine professional development available and how to ensure teacher access to the professional development.
- Engage teachers on how 3 dimensions can be incorporated into lessons.
- Connect what is happening with science in your building or district with other buildings or districts in the state.

Questions?



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