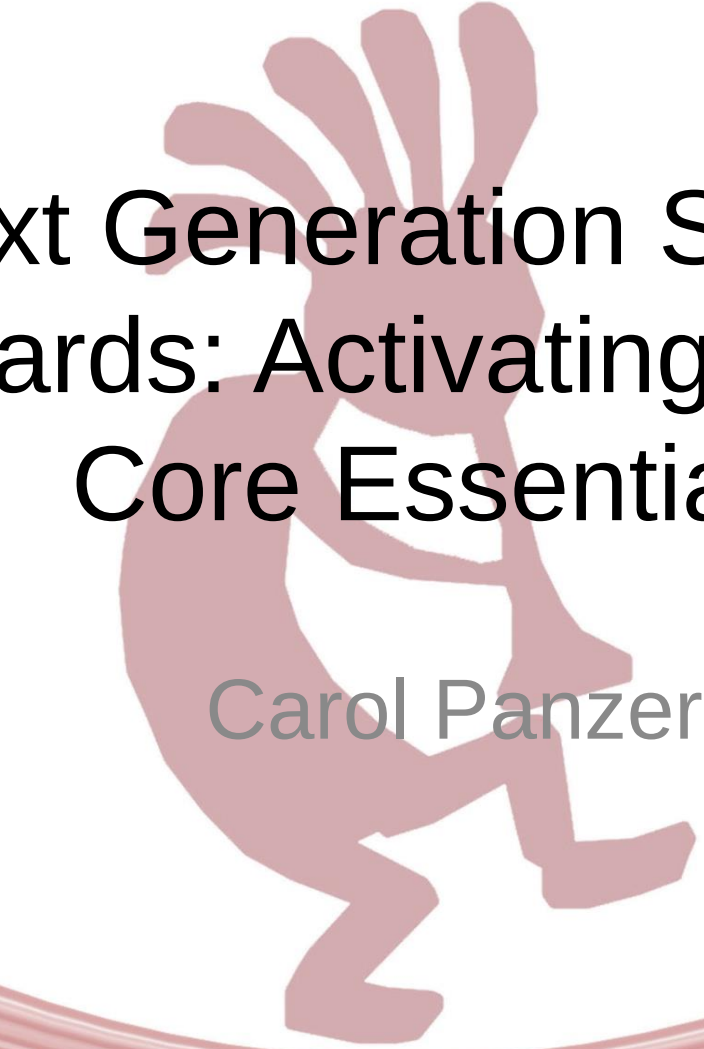
Next Generation Science Standards: Activating Common Core Essentials

Carol Panzer



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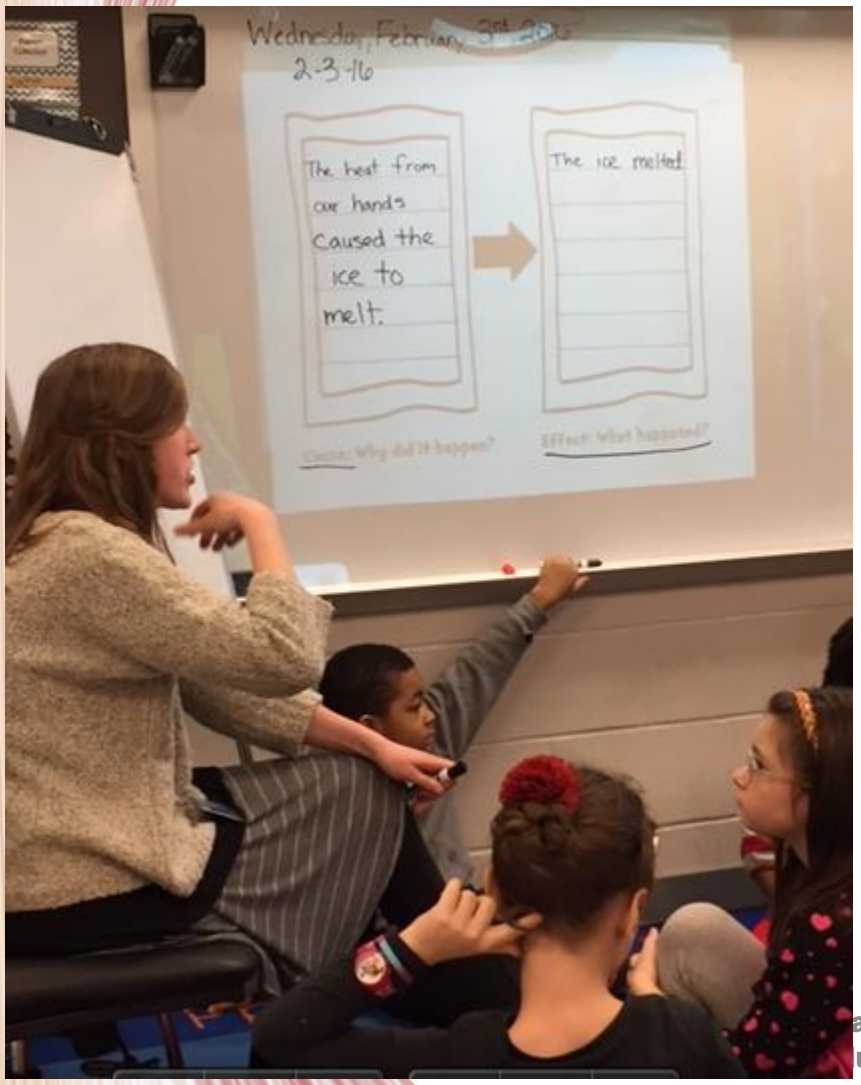
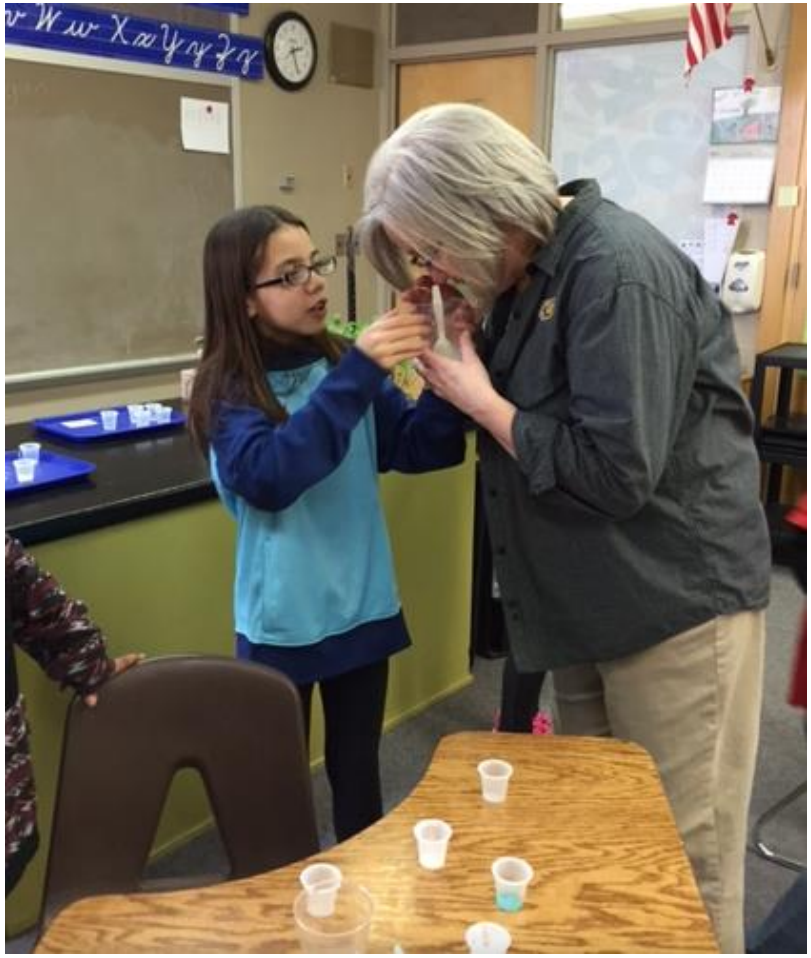
Why textbooks aren't enough!

Introductions





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Objectives for the Day

- Review the NGSS vision
- Strengthen the USD #355 science team by aligning instruction to NGSS
- Learn about AC^{2}E Notebooks
- Learn about some other resources that support science instruction

How long has Kansas had NGSS?

- Show your guess!!

How long has Kansas had NGSS?

- Show your guess!!

Kansas adopts the NGSS

SHARE

GLENN BRANCH | 06.12.2013

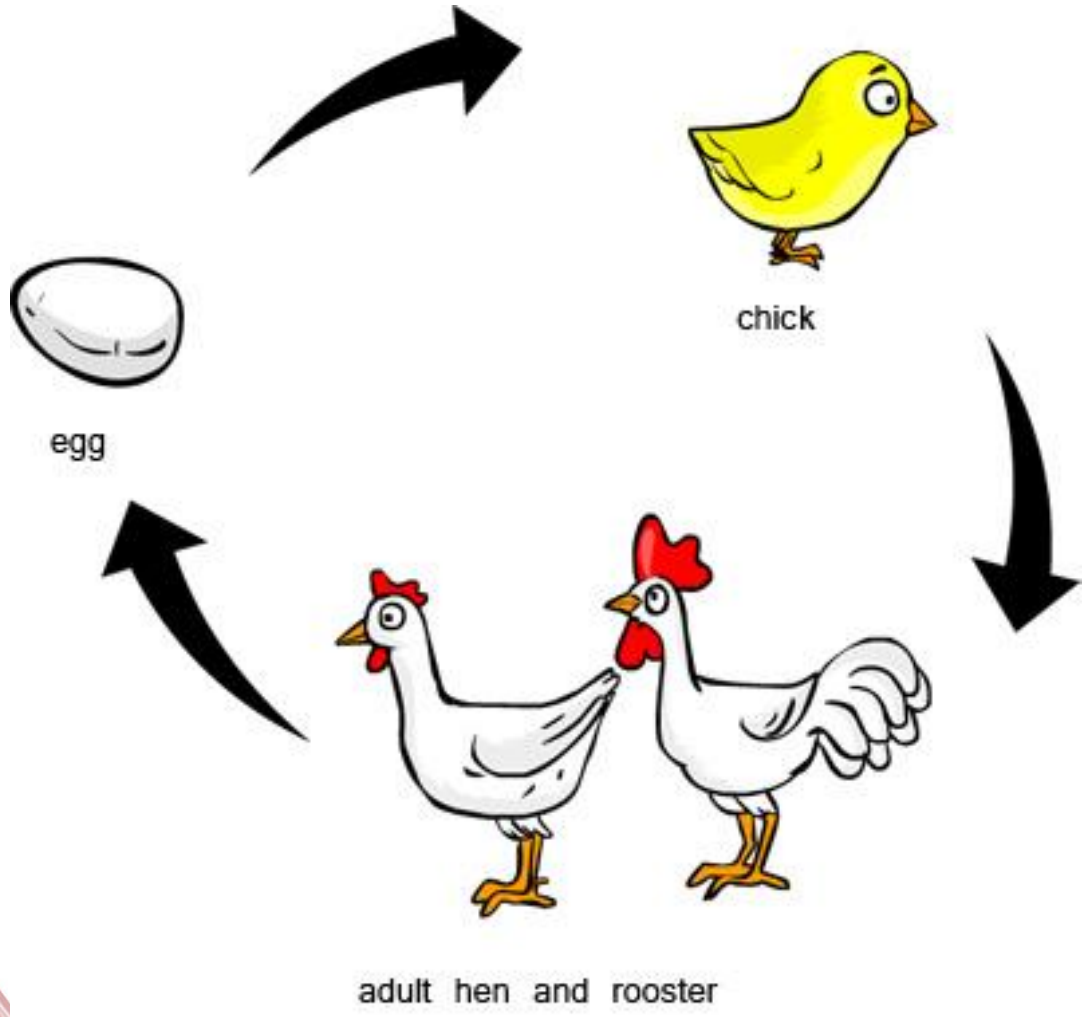
Line Up

- 1-10 How much do you know about NGSS?
- 1—I can spell NGSS but I am not sure what the initials
- 10—I know what PEs, DCIs, Crosscutting Concepts are and which ones I am supposed to teach

Activating Common Core Essentials

- The AC^{2}E was designed to give teachers a resource to help incorporate the NGSS Performance Expectations into lessons that could be included in larger units…
- This NOT intended to be the district curriculum…
- Teachers must…consider ALL three dimensions…science/engineering, DCIs, and Crosscutting Concepts

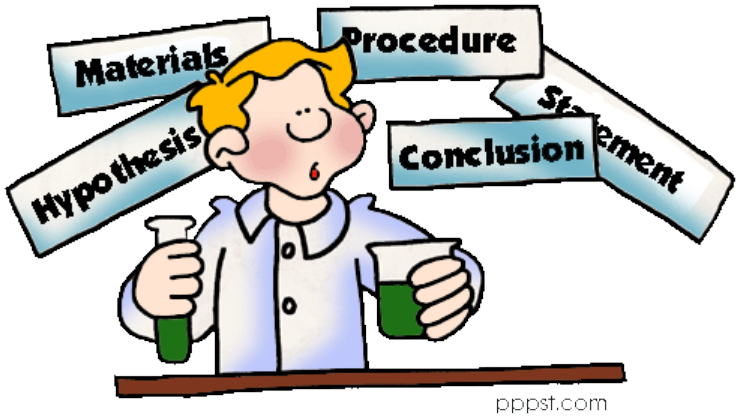
What I learned from this…



How is this science?

What has science looked like in the past?

- Textbooks
- Films/videos
- “Experiments”
- THE Scientific method
- Tests that emphasize memorizing



How will science education change with NGSS?

Implications of the Vision of the Framework for K-12
Science Education and the Next Generation Science Standards

SCIENCE EDUCATION WILL INVOLVE LESS:	SCIENCE EDUCATION WILL INVOLVE MORE:
Rote memorization of facts and terminology	Facts and terminology learned as needed while developing explanations and designing solutions supported by evidence-based arguments and reasoning.
Learning of ideas disconnected from questions about phenomena	Systems thinking and modeling to explain phenomena and to give a context for the ideas to be learned

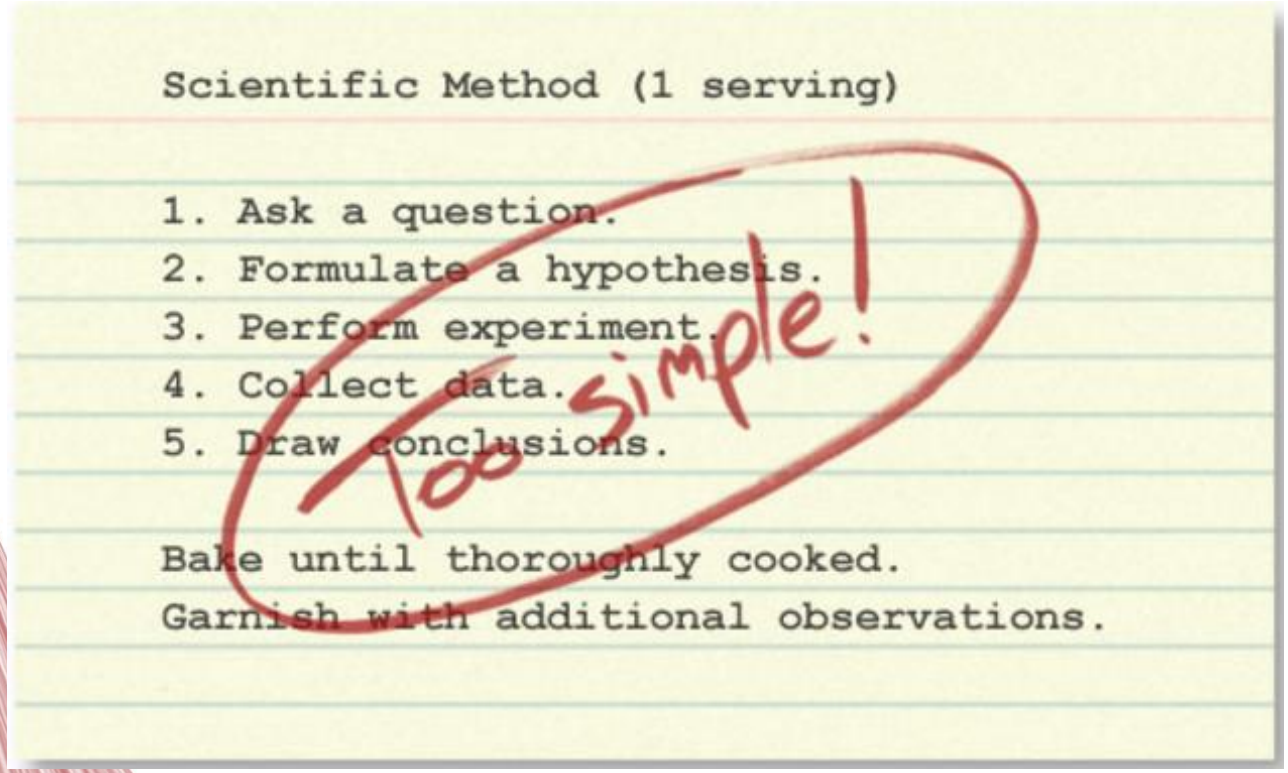
Teachers providing information to the whole class	Students conducting investigations, solving problems, and engaging in discussions with teachers' guidance
Teachers posing questions with only one right answer	Students discussing open-ended questions that focus on the strength of the evidence used to generate claims
Students reading textbooks and answering questions at the end of the chapter	Students reading multiple sources, including science-related magazine and journal articles and web-based resources; students developing summaries of information.

Pre-planned outcome for "cookbook" laboratories or hands-on activities	Multiple investigations driven by students' questions with a range of possible outcomes that collectively lead to a deep understanding of established core scientific ideas
Worksheets	Student writing of journals, reports, posters, and media presentations that explain and argue
Oversimplification of activities for students who are perceived to be less able to do science and engineering	Provision of supports so that all students can engage in sophisticated science and engineering practices

Cognitive Dissonance

- **Controlled investigations**
  - Experiments as we have known them in the past (variables, etc.)
- **Open investigations**
  - Discuss examples

The Nature of Science

- 

Nature of Science

- Science is a way of knowing
- Science is a human endeavor
- Science addresses questions about the natural and material world
- Scientific knowledge is based on a variety of methods

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- Science laws, models, mechanisms, and theories explain natural phenomena
- Scientific knowledge is based on empirical evidence
- Scientific knowledge is open to revision in light of new evidence
- Scientific knowledge assumes an order and consistency in natural systems

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Search

- What is empirical evidence?

Hint---you have tools!!

What do you see and what is your evidence?

Let's be scientists!!
Do a quick write.

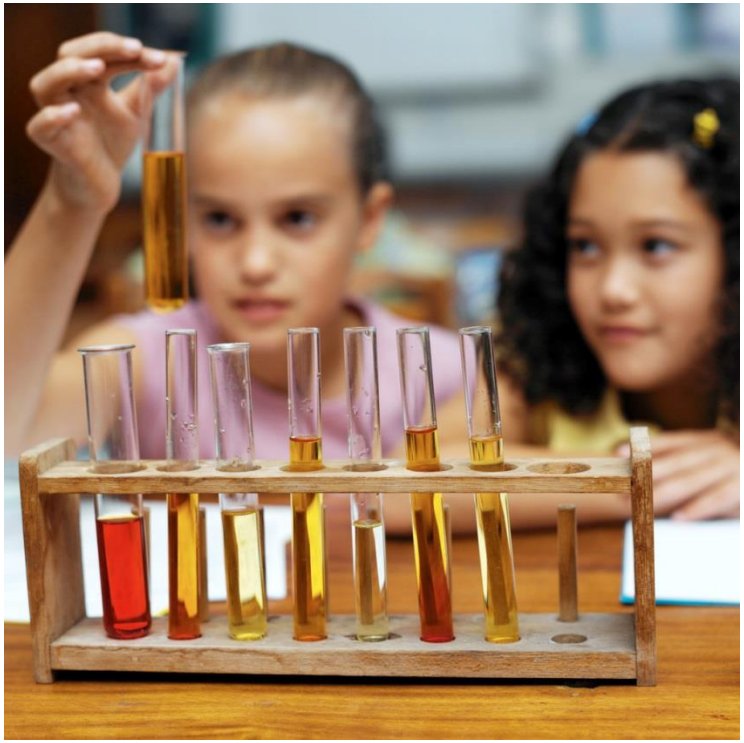
Scaffold: I see…; I think…; I wonder…

Where is the evidence?

Science Scope (NSTA) has also featured Mystery Photos

Next Generation Science Standards

- http://www.nextgenscience.org/next-generation-science-standards
- NGSS app



Students who demonstrate understanding can:

4-PS3-1. **Use evidence to construct an explanation relating the speed of an object to the energy of that object.** [*Assessment Boundary: Assessment does not include quantitative measures of changes in the speed of an object or on any precise or quantitative definition of energy.*

4-PS3-2. **Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.** [*Assessment Boundary: Assessment does not include quantitative measurements of energy.*]

4-PS3-3. **Ask questions and predict outcomes about the changes in energy that occur when objects collide.** [Clarification Statement: Emphasis is on the change in the energy due to the change in speed, not on the forces, as objects interact.] [*Assessment Boundary: Assessment does not include quantitative measurements of energy.*]

4-PS3-4. **Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.*** [Clarification Statement: Examples of devices could include electric circuits that convert electrical energy into motion energy of a vehicle, light, or sound; and, a passive solar heater that converts light into heat. Examples of constraints could include the materials, cost, or time to design the device.] [*Assessment Boundary: Devices should be limited to those that convert motion energy to electric energy or use stored energy to cause motion or produce light or sound.*]

4-ESS3-1. **Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.** [Clarification Statement: Examples of renewable energy resources could include wind energy, water behind dams, and sunlight; non-renewable energy resources are fossil fuels and fissile materials. Examples of environmental effects could include loss of habitat due to dams, loss of habitat due to surface mining, and air pollution from burning of fossil fuels.]

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

Asking Questions and Defining Problems
Asking questions and defining problems in grades 3–5 builds on grades K–2 experiences and progresses to specifying qualitative relationships.

- Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships. (4-PS3-3)

Planning and Carrying Out Investigations
Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.

- Make observations to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. (4-PS3-2)

Constructing Explanations and Designing Solutions
Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to

Disciplinary Core Ideas

PS3.A: Definitions of Energy

- The faster a given object is moving, the more energy it possesses. (4-PS3-1)
- Energy can be moved from place to place by moving objects or through sound, light, or electric currents. (4-PS3-2),(4-PS3-3)

PS3.B: Conservation of Energy and EnergyTransfer

- Energy is present whenever there are moving objects, sound, light, or heat. When objects collide, energy can be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated and sound is produced. (4-PS3-2), (4-PS3-3)
- Light also transfers energy from place to place. (4-PS3-2)
- Energy can also be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat, or light. The currents may have been produced to begin with by transforming the energy of motion into electrical energy. (4-PS3-2),(4-PS3-4)

Crosscutting Concepts

Energy and Matter

- Energy can be transferred in various ways and between objects. (4-PS3-1),(4-PS3-2),(4-PS3-3), (4-PS3-4)

Cause and Effect

- Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1)

Connections to Engineering, Technology, and Applications of Science

Interdependence of Science, Engineering, and Technology

- Knowledge of relevant scientific concepts and research findings is important in engineering. (4-ESS3-1)

Influence of Engineering, Technology, and Science on Society and the Natural World

- Over time, people's needs and wants change, as do their demands for new and improved technologies. (4-ESS3-1)

	by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. *(secondary to 4-PS3-4)*	

Connections to other DCIs in fourth grade: N/A

Articulation of DCIs across grade-levels:

K.PS2.B (4-PS3-3); **K.ETS1.A** (4-PS3-4); **2.ETS1.B** (4-PS3-4); **3.PS2.A** (4 -PS3-3); **5.PS3.D** (4-PS3-4); **5.LS1.C** (4-PS3-4); **5.ESS3.C** (4-ESS3-1); **MS.PS2.A** (4-PS3-3); **MS.PS3.A** (4-PS3-1),(4-PS3-2),(4-PS3-3),(4-PS3-4); **MS.PS3.B** (4-PS3-2),(4-PS3-3),(4-PS3-4); **MS.PS3.C** (4-PS3-3); **MS.PS3.D** (4-ESS3-1); **MS.PS4.B** (4-PS3-2); **MS.ESS2.A** (4-ESS3-1); **MS.ESS3.A** (4-ESS3-1); **MS.ESS3.C** (4-ESS3-1); **MS.ESS3.D** (4-ESS3-1); **MS.ETS1.B** (4-PS3-4); **MS.ETS1.C** (4-PS3-4)

Common Core State Standards Connections:

ELA/Literacy -

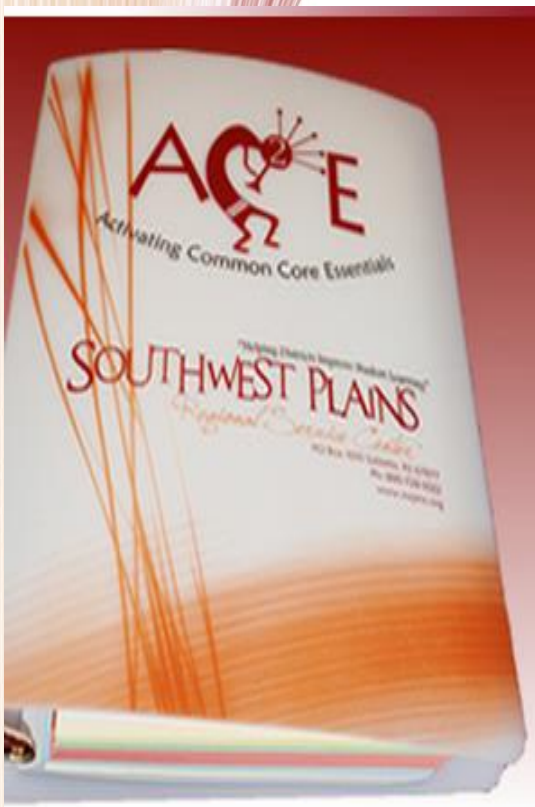
RI.4.1	Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text. (4-PS3-1)
RI.4.3	Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text. (4-PS3-1)
RI.4.9	Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably. *(4-PS3-1)*
W.4.2	Write informative/explanatory texts to examine a topic and convey ideas and information clearly. (4-PS3-1)
W.4.7	Conduct short research projects that build knowledge through investigation of different aspects of a topic. (4- PS3-2),(4-PS3-3),(4-PS3-4),*(4-ESS3-1)*
W.4.8	Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources. (4-PS3-1),(4-PS3-2),(4-PS3-3),(4-PS3-4),(4-ESS3-1)
W.4.9	Draw evidence from literary or informational texts to support analysis, reflection, and research. (4-PS3-1),*(4-ESS3-1)*

Mathematics -

MP.2	Reason abstractly and quantitatively. *(4-ESS3-1)*
MP.4	Model with mathematics. *(4-ESS3-1)*
4.OA.A.1	Interpret a multiplication equation as a comparison, e.g., interpret 35 = 5 × 7 as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations. (4-ESS3-1)
4.OA.A.3	Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding. *(4-PS3-4)*

' The performance expectations marked with an asterisk integrate traditional science content with engineering through a Practice or Disciplinary Core Idea.

AC2E Science Notebooks



Activating Common Core Essentials (AC2E) now available for Science!

Grades

K-2 and 3-5

6-8

see Instructional Resources: AC2E for details and order information

Organization of the Notebooks

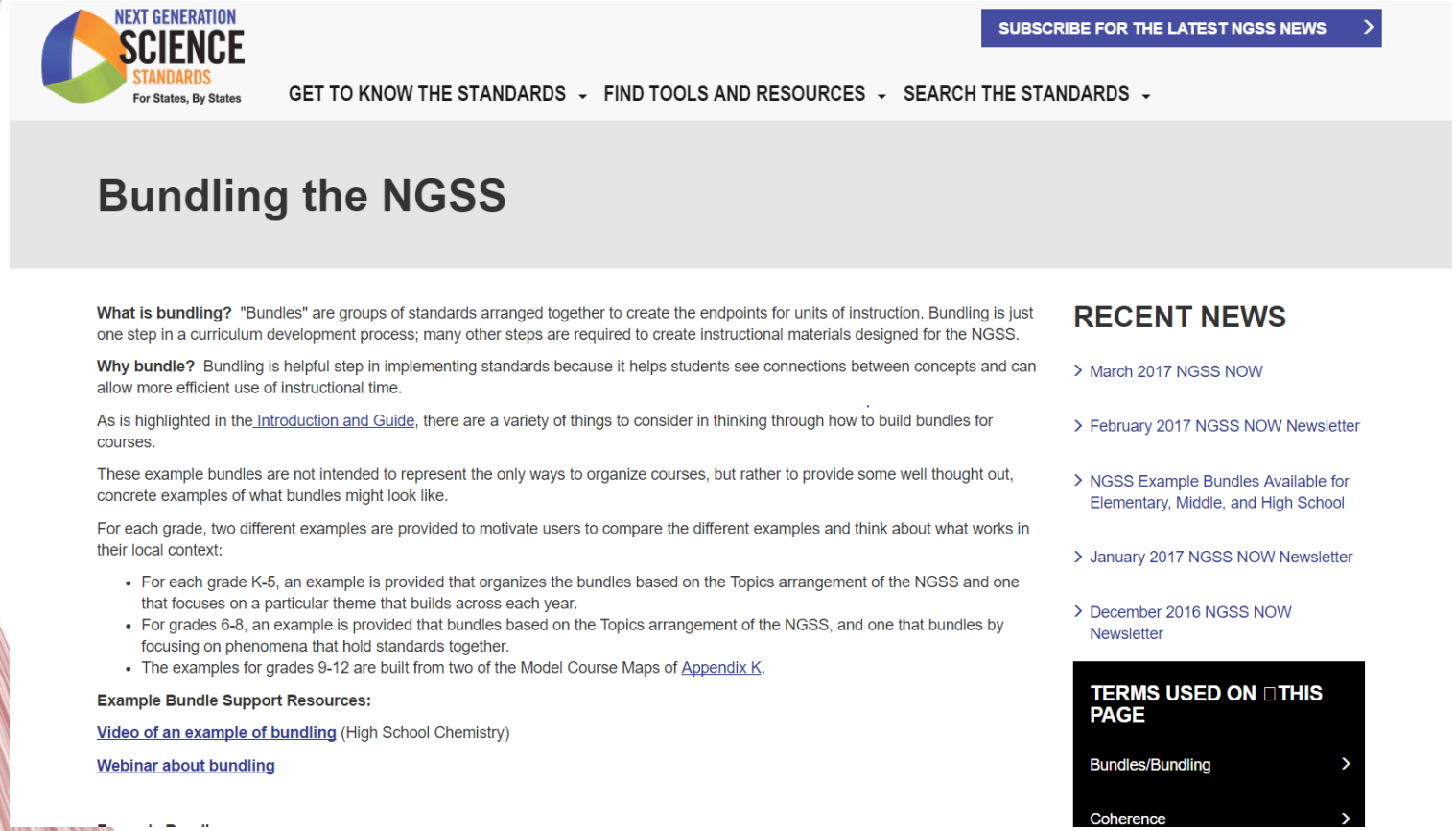
- K-12 NGSS—organized by DCIs or Topics
- MS and HS—organized by Conceptual Progressions or Domains

- **AC²E Notebooks arranged by Topics**
- **You MUST refer to NGSS continually**

Organization of the Cards

- Performance Expectation (NGSS)
- Clarification Statement (NGSS)
- Time
- Resources
- Gathering Information (paper airplanes)
- Reasoning
- Communicating
- 3 Dimensions

http://nextgenscience.org/resources/bundling-ngss



CCRS—ELA Grades K-5

- Kindergarten: Use a combination of drawing, dictation, and writing to compose opinion pieces…and/or informative/explanatory texts…
- Fifth Grade: Write opinion pieces on topics or texts, supporting a point of view with reasons and information.

CCRS—ELA 8-11

- 8th—Write arguments to support claims with clear reasons and relevant evidence
- 11th—Write arguments to support claims in an analysis of substantive topics or texts using valid reasoning and relevant and sufficient evidence

Forces and Interactions K-PS2-1

- PE: Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object
- Next: How it links to K-PS2-2

Forces and Interactions
K-PS2-2

- Rollin' Rollin' Rollin'
  - PE: **Analyze** data to determine if a design solution works as intended to change the speed or direction of an object with a push or pull
  - DCI: Pushes and pulls can have different strengths and directions
  - DCI: Pushing and pulling on an object can change the speed or direction

Forces and Interactions K-PS2-2

- Rollin' Rollin' Rollin'
  - Focus question: How can we make the ball roll in different directions?

Forces and Interactions 3-PS2-1

PE: Plan and conduct an investigation to provide evidence of the effect of balanced and unbalanced forces on the motion of an object.

DCIs for 3-PS2-1

- Each force acts on one particular object and has both strength and direction. An object at rest typically has multiple forces acting on it, but they add up to give a zero net force..
- Objects in contact exert forces on each other.

Physical Science
Waves and Light

1 PS4-1 How is sound created?

- Throat
- Rubber bands
- Balloon
- Conclusion: Sound is created by_____.
- Our evidence is _____. We observed that when we_____.

2-PS1-3

- PE: Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object. --EXAMPLE
- DCI: Different properties are suited to different purposes.
- DCI: A great variety of objects can be built up from a small set of pieces.

In addition…

- Science/Engineering Practices: Make observations (first hand or from media) to construct an evidence-based account for natural phenomena.
- Crosscutting Concepts: Energy and Matter—Objects may break into smaller pieces and be put back together into larger pieces or change shapes.

MS-PS1-1

- PE: Develop models to describe the atomic composition of simple molecules and extended structures.
- DCI: Substances are made from different types of atoms, which combine with one another in various ways.
- DCI: Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g. crystals)

Middle School

- First district have to study and divide the 6-8 Performance Expectations
- That can be done by physical science, life science, earth and space
- OR---each PE can be divided
- HOWEVER each grade should do the Engineering, Technology and Applications of Science

Explore the Notebooks

Listen to your students

- What is a bird's favorite color?

Get students to ask questions

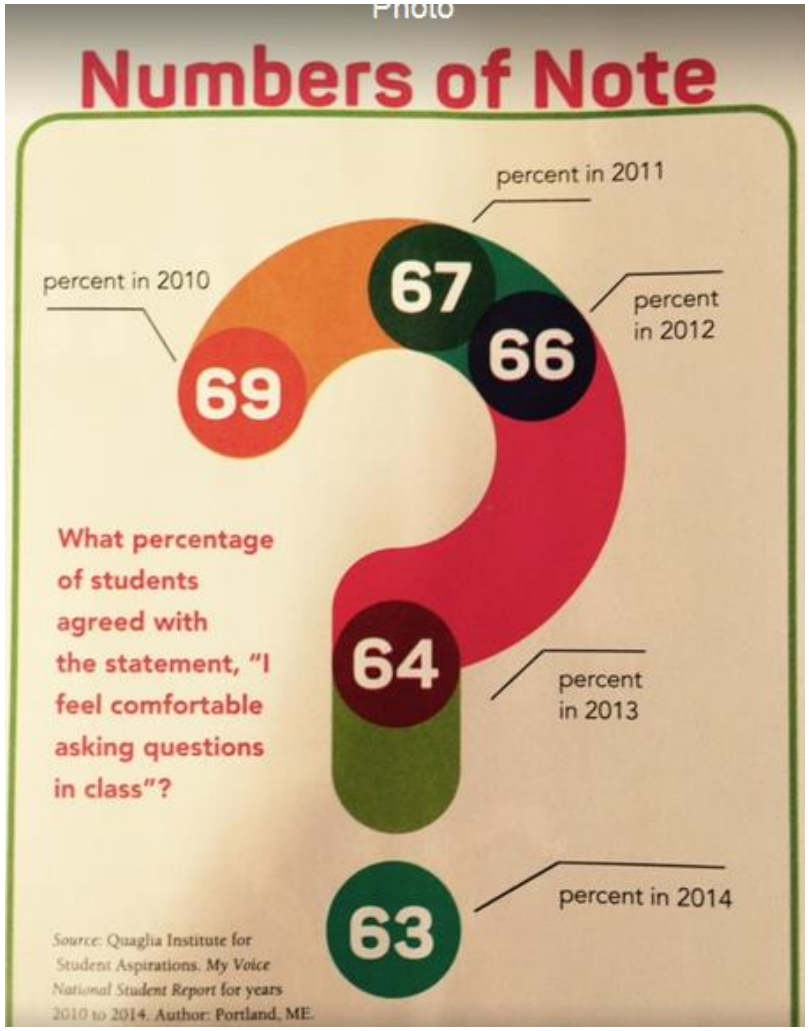
- Asking questions turns students into critical thinkers
- When students ask questions, we get a better sense of their true understanding
- When students ask questions, they are more engaged in their learning

Think about this…

- How did Edison invent the light bulb?
- How was penicillin discovered?
- How were engineers able to build computers that will fit into our pockets?
- **They all started with “questions”!!**

How to get kids to ask questions

- Create a “safe” environment



- Use brainstorming time with groups
- **Be selective about the questions you answer…try responding with another question**
- Model asking questions that you don’t know the answer to
- Honor student questions
- Make it a point to ask: What questions does this create in your mind?

Crosscutting Concepts

- Appendix G
- Crosscutting Concepts: http://ngss.nsta.org/CrosscuttingConceptsFull.aspx

- **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.***

- ***Finding connections is how you make science fit!***

Snow Flakes

Coffee filters
Washable markers
Q-Tips or eyedroppers or spray bottles
Which CC fits???
What question would you ask?
How does this support ELA?

www.newsela.com

NEWSELA War & Peace Science Kids Money Law Health Arts

Science

SCIENCE

07.07.14

This privacy debate could drone on

More and more people are using drones to take videos of parks, sunsets and beaches

SCIENCE

06.24.14

Teen science club projects blast off

SCIENCE

06.23.14

Hungry frogs snatch prey with their "ballistic tongues"

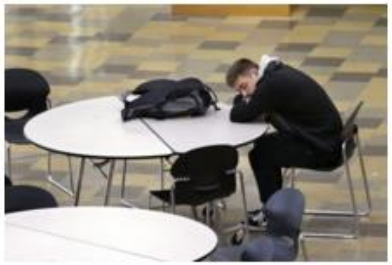
tweentribune

TT Teacher Resources

Check out the latest Monday Morning Ready! Click here to read TV outpaces Hollywood on diversity

Teacher News

Today's top trends in teaching



December 21, 2015

High schools listening to scientists, letting teens sleep

Lesson Plans

Profile a Minority Artist

Create a Book Award

Write About It

Create an Interactive Map

Research, Redesign and Report

VIEW MORE

Smithsonian Resources

African American Artists: Masking Matters

This set of lesson provides ideas for a study of the art

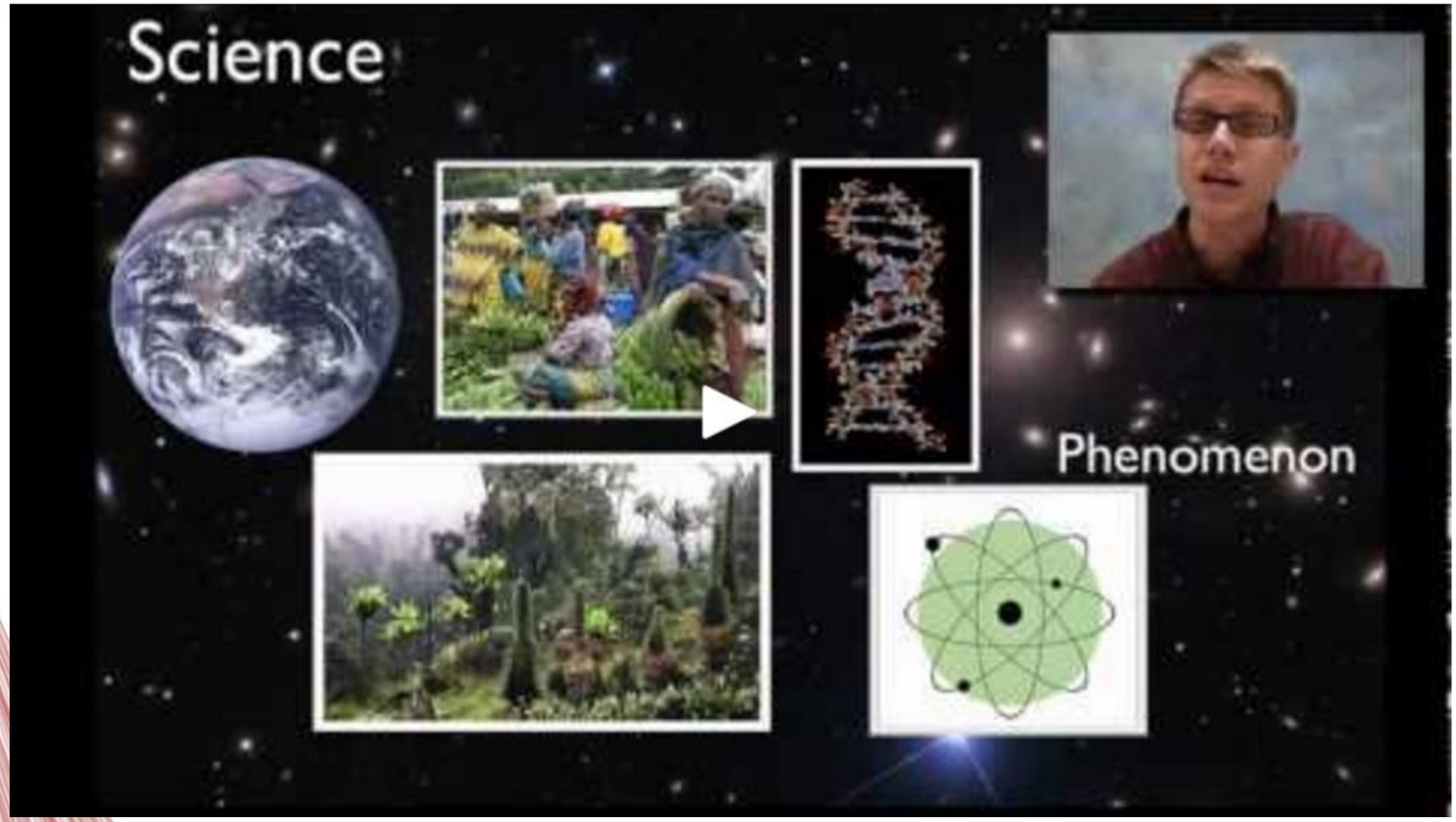
TEACHER RESOURCES

- Teacher Dashboard
- Articles
- Smithsonian Resources
- Lesson Plans
- Monday Morning Ready

Resources you should consider

- NSTA—National Science Teachers Association (elementary, middle school, high school, and college levels)
- www.newsela.com
- www.tweentribune.com/

http://www.bozemanscience.com/next-generation-science-standards/



Ask yourselves…

How do I plan to incorporate each of these:

- PEs
- DCIs
- Crosscutting Concepts
- Science and Engineering Practices

Thank you for your time today!
Continue exploring NGSS