Next Generation Science Standards: Build Literacy Skills

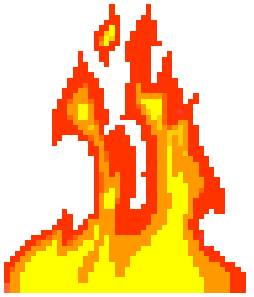
Carol Panzer

LOOK at materials while you wait!!

PROFESSIONAL LEARNING...INNOVATIVE SOLUTIONS
SOUTHWEST PLAINS
REGIONAL SERVICE CENTER

- College Credit
- --Papers due in one week

- Introductions—and burning questions



- What do you hope to take away today?
- Lunch—11:30

Safety First

- Handouts

Professional Learning...
Innovative Solutions

State Assessments

- Summative assessments—reduced by 60% 2016-17
- One testing window March-April
- All performance (MDPT & Math & Listening)—interim
- Science—5, 8, 11—2 stages (each 45-60 minutes)
- 2016 Science=Field test so no scores will be reported until next year

Why SCIENCE?? STEM/STEAM

- Rigor
- Relevance
- Responsive Culture
- Relationships
- Results

- Teachers have to keep learning!

ELLs in Science

- CALP and BICS can be learned at the same time
- Quote from NSTA: When students explain their projects to peers, their confidence builds. This is a reason for supporting hands-on learning and NGSS…Notetaking and journaling [are] key strategies…they are important language connections.

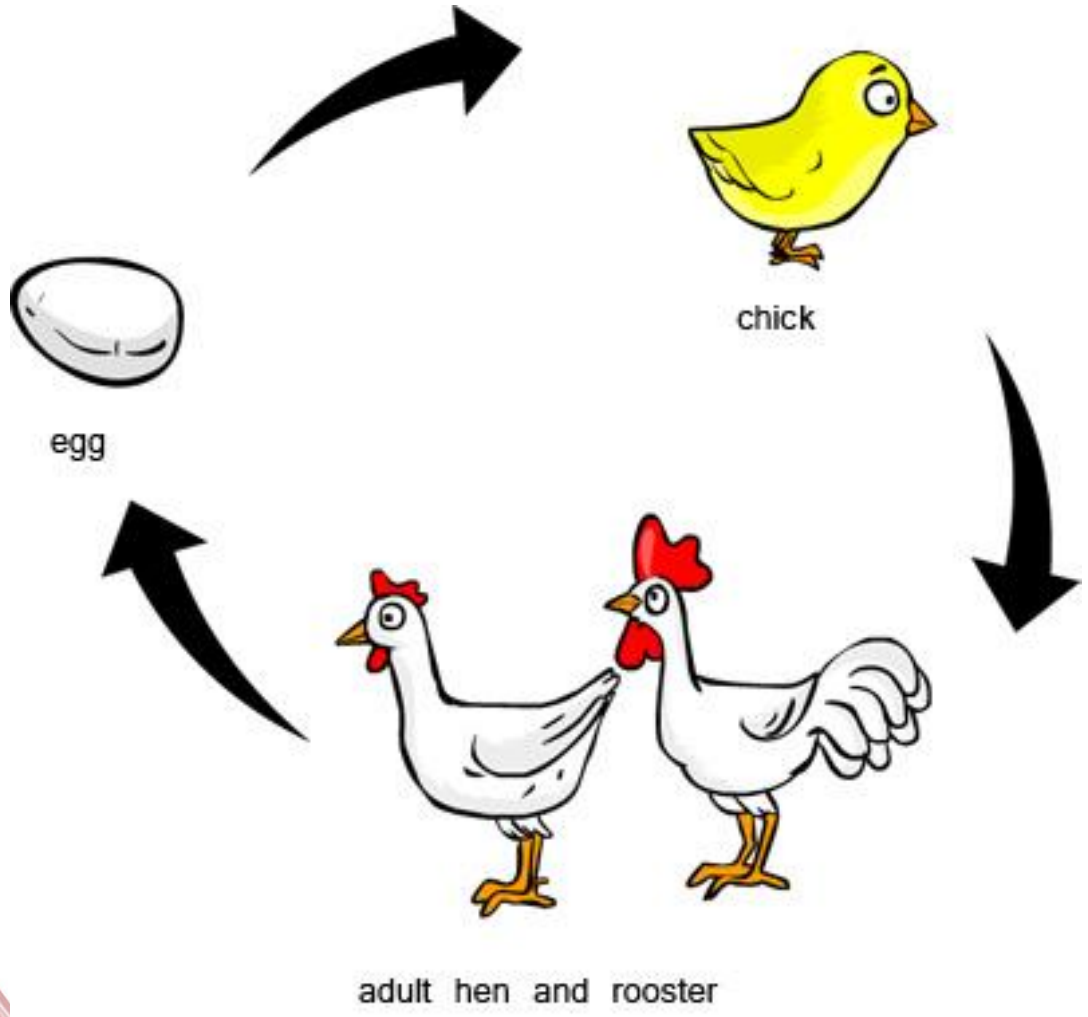

Outstanding
What happens in different kinds of weather?

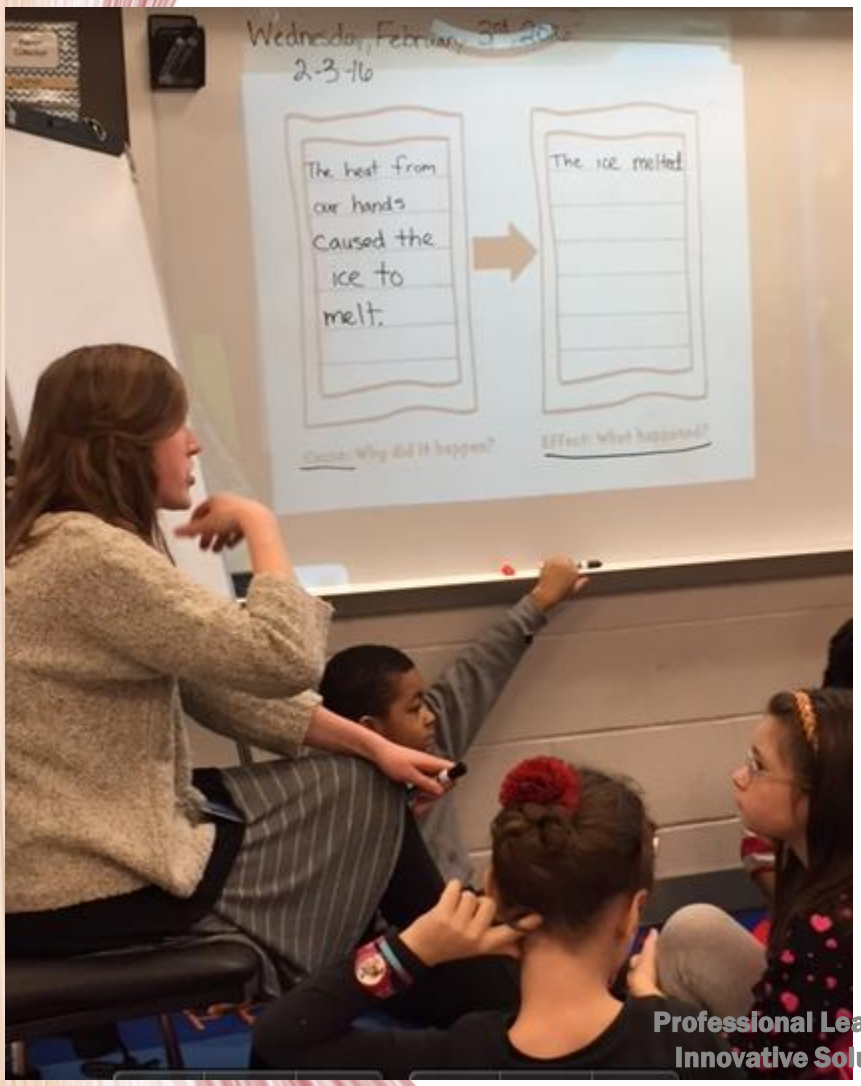
From NSTA Reports

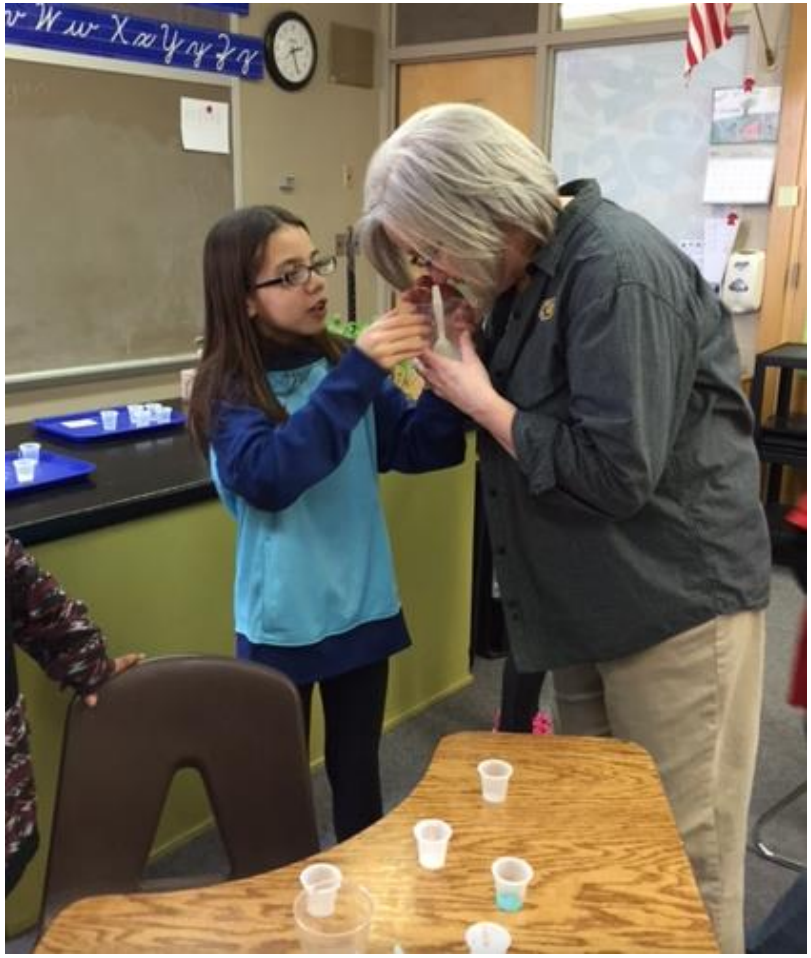
- See Blick on Flicks
- http://www.nsta.org/publications/blickonflicks.aspx
- Inside out
- The Martian
- The Ant-Man

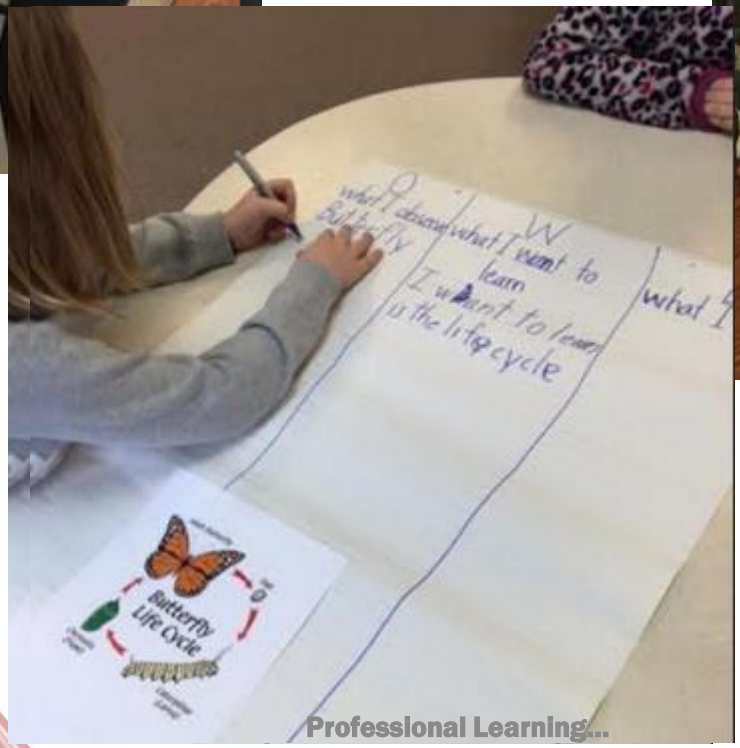
- Teach kids how to do an observation

What I learned from this…

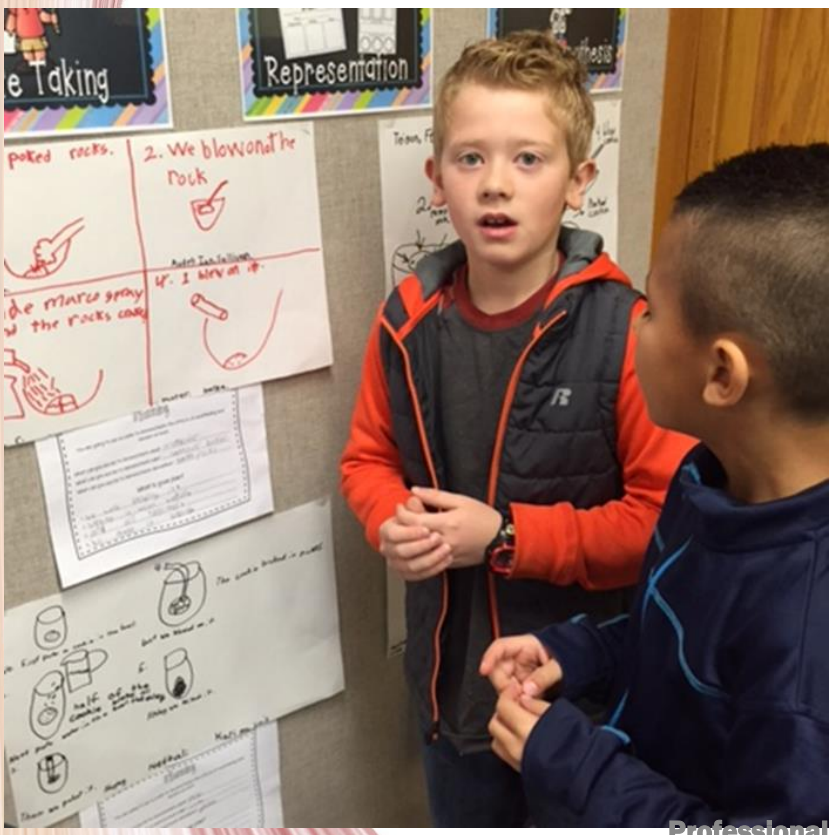


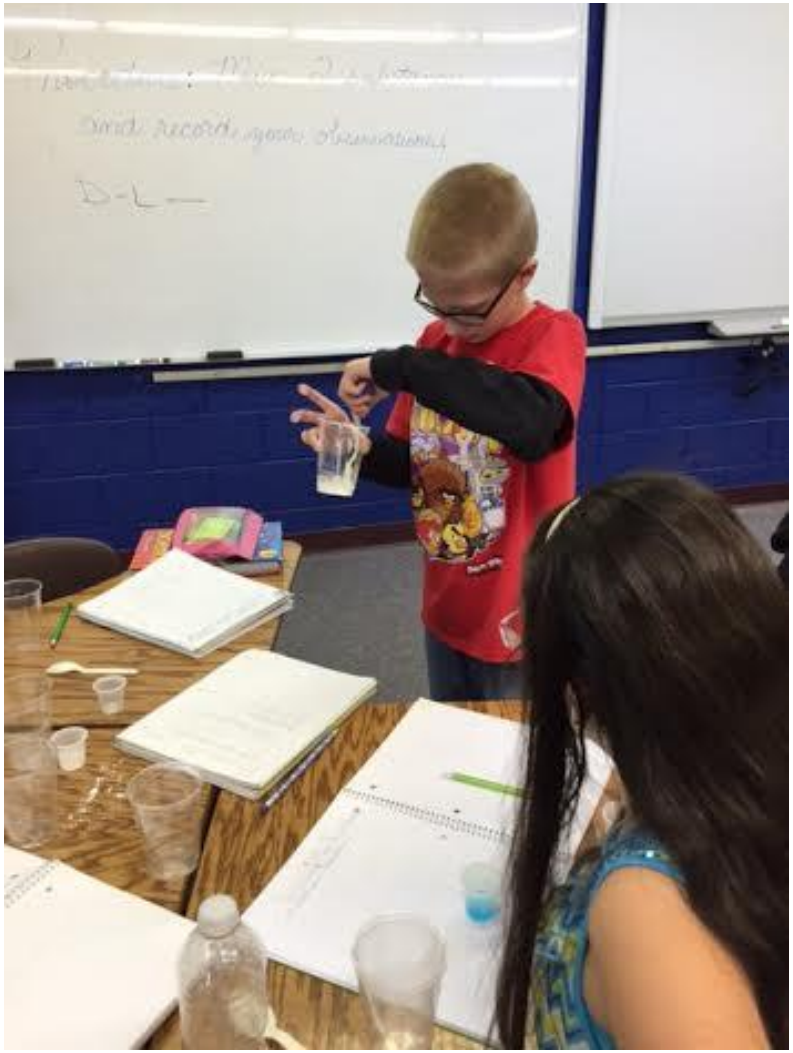

2-3-16
The heat from our hands caused the ice to melt.
The ice melted

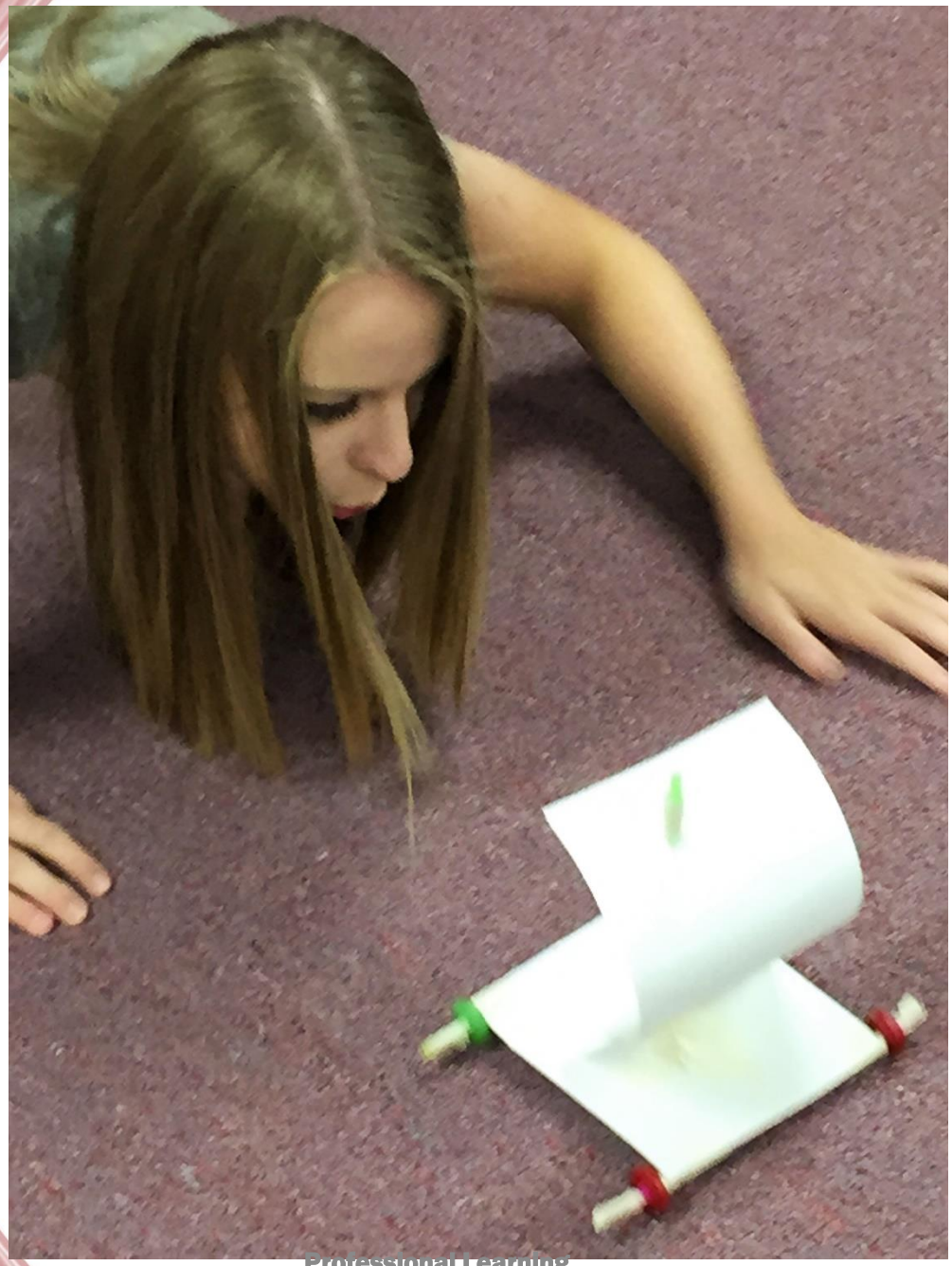



what I want to learn
Butterfly Life Cycle


Yasmin
PS
Aéro


e Taking
Represemation
2. We blewonthe rock





How is this science?

Mystery Box

- https://www.youtube.com/watch?v=vrAGg-bKMho The mystery box
- https://www.youtube.com/watch?v=j12BBcKSgEQ The scientific method is crap
-
- https://www.youtube.com/watch?v=cavz05XYWyk Page Keeley

Who is a “scientist”?

Debate Team Carousal

1. I think scientist just try out different things until something works.
2. I think there is a definite set of steps all scientists follow call the “scientific method”.
3. I think scientists use different methods depending on their question.
4. I think scientists use different methods but they all involve doing experiments.

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

- **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**

Search

- What is empirical evidence?

Hint---you have tools!!

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

What do you see and what is your evidence?

Clarification

- Observations are descriptive statements about natural phenomena commonly obtained through your senses
- Inferences are statements about phenomena inaccessible to the senses
- (Not facts and guesses!)

Cognitive Dissonance

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

In Science

- During science investigations we want students to collect data and form evidence-based conclusions.
- We must explicitly teach that scientific knowledge is **empirically based.**
- **We must teach students how to OBSERVE and record their observations.**

What would a good science lesson look like? Jot down key words.

- **Writing in Science in Action---** Soil

Describe the lesson

- **Could your students do this today?**
- **What barriers would they encounter?**
- **What barriers do you anticipate?**

- **What are the advantages to this lesson?**

- Higher order thinking
- Writing—using evidence
- Student engagement
- Speaking and listening –academic vocabulary
- Multiple intelligences
- Modeling
- Scaffolding/differentiation

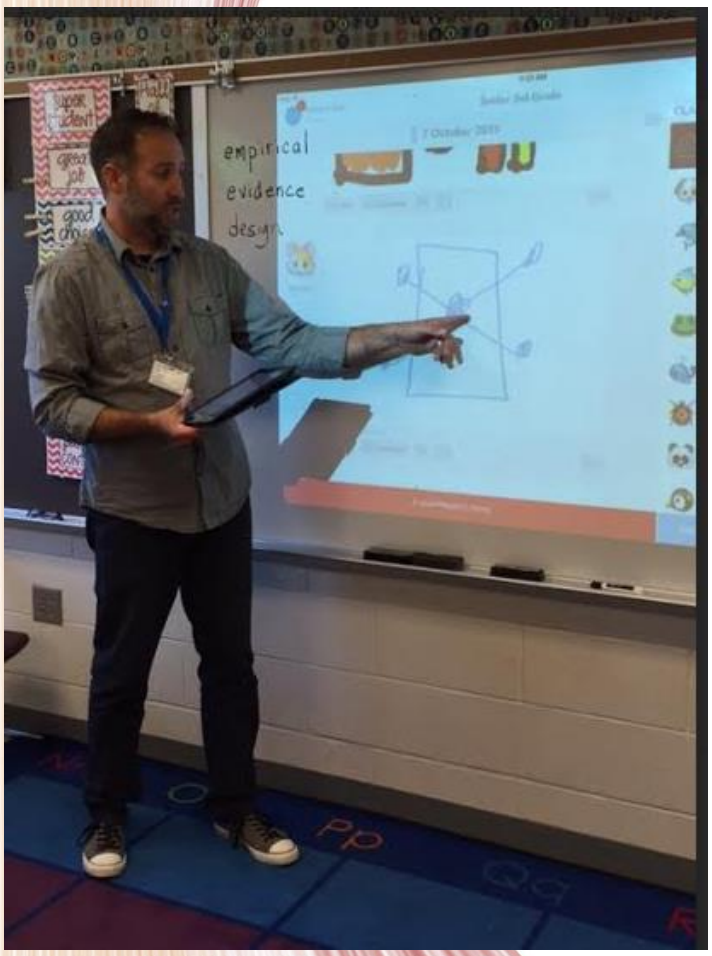
How close are we to the vision in the video clip? How is literacy supported?

- In groups, discuss this question.
- Why didn't the previous Inquiry Standard result in that vision?

Writing

- Writing Out Loud (Like Think Aloud)
- Shared Writing
- Guided Writing –could be pictures
- Independent Writing

- This is gradual release of instruction



Seesaw

Quick look:

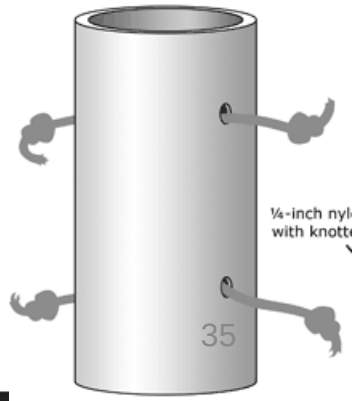
https://www.youtube.com/watch?v=tlw-tUKvnNc

https://www.youtube.com/watch?v=PwV_VXaQNCg&feature=youtu.be

Mystery Tube

Go to seesaw app

- Focus question: **What does the inside of the tube look like?**
- Record observations about these tubes (Create a chart)
- From your observations, draw the inside of the tube.
- Are you doing science?
- Are all the tubes alike?



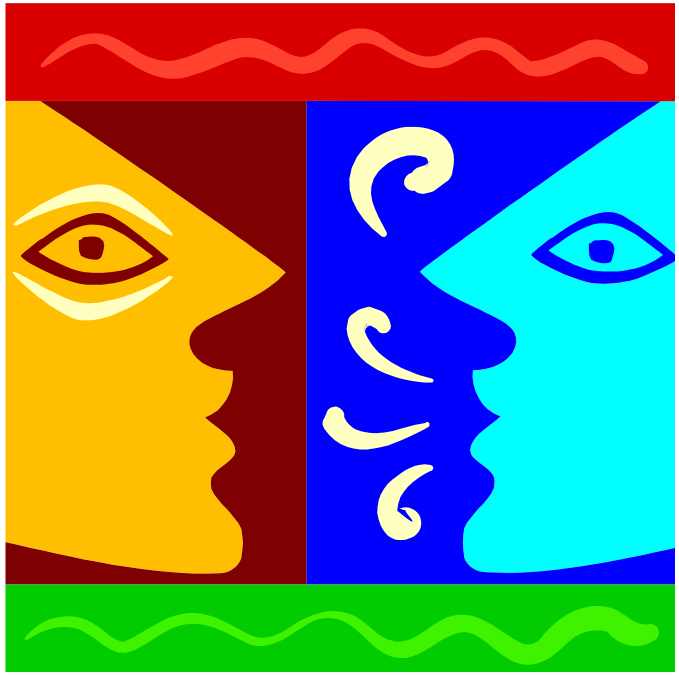
Interactive Science Journals

- Electronic---one way
- Interactive paper—foldables
  - Use Sticky Notes or glue in Tabs
  - Waterfall organizers
  - Envelopes for notecards
  - Manila envelopes for handouts or articles

Consider Guided Writing: Great Scaffolding/DI

- I observed_____.
- I think that _____ because_____.
- I also think_____.
- In addition I think_____.
- My evidence is _____.

Paraphrase Passport



Listening/speaking standards

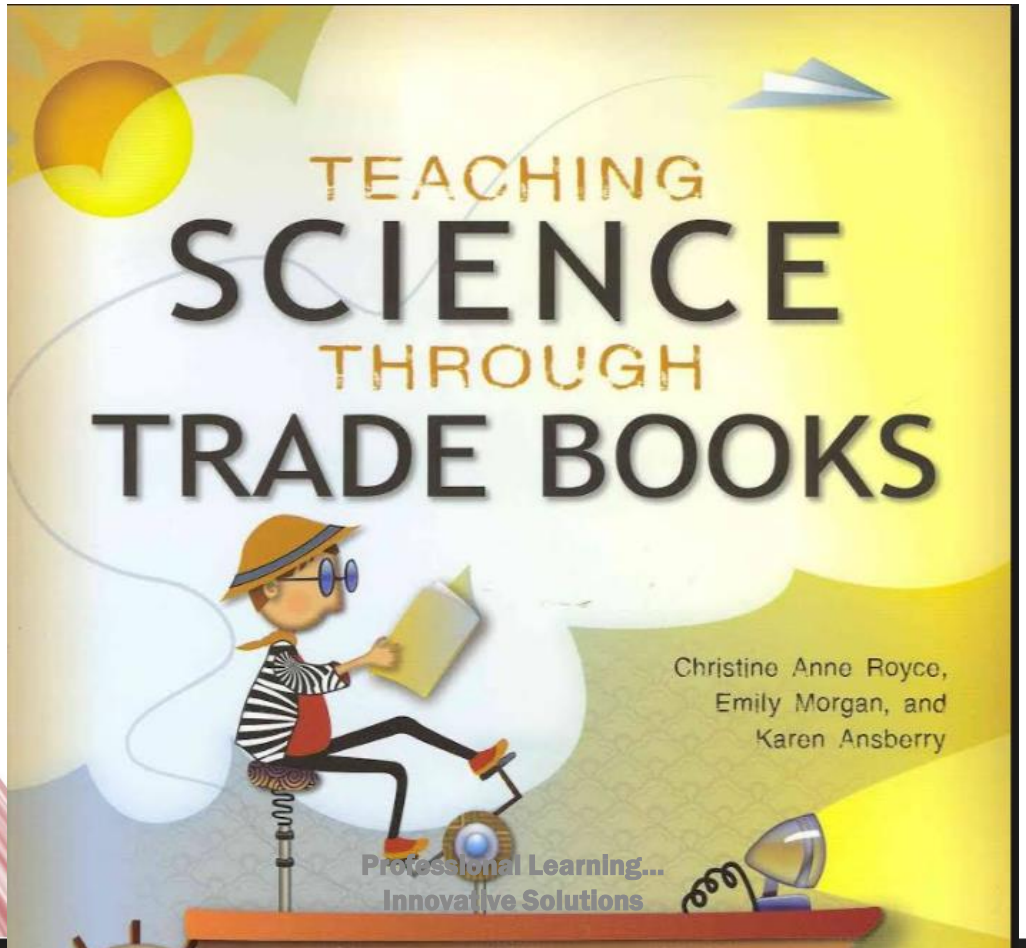
Check Burning Questions

Quick Brainstorm

- Write down every topic you cover that is related to science
  - Books your read aloud
  - Stories in the basal reader
  - Art projects
  - Community service projects
  - Songs from music
  - PE/Health activities

Literature in Science

- Graeme Base: ***The Water Hole***



Reading Relevance

- https://www.teachingchannel.org/videos/teaching-science-with-current-events

Online and Printed

- Popular Science
- Newsela

- Harry Potter or Albert Einstein: Scientists build tiny invisibility cloak

Close Reading

- See article by Jeff Martin
- Read “What to Expect from the New Standards”
- Use a + to note something you agree with; ? to note something you question or don’t understand; ! to note a surprise
- How could you use this in class?

Handout

- Shifts to current standards

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

see Instructional Resources: AC2E for details and order information

Forces and Interactions K-PS2-2

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

Forces and Interactions K-PS2-2

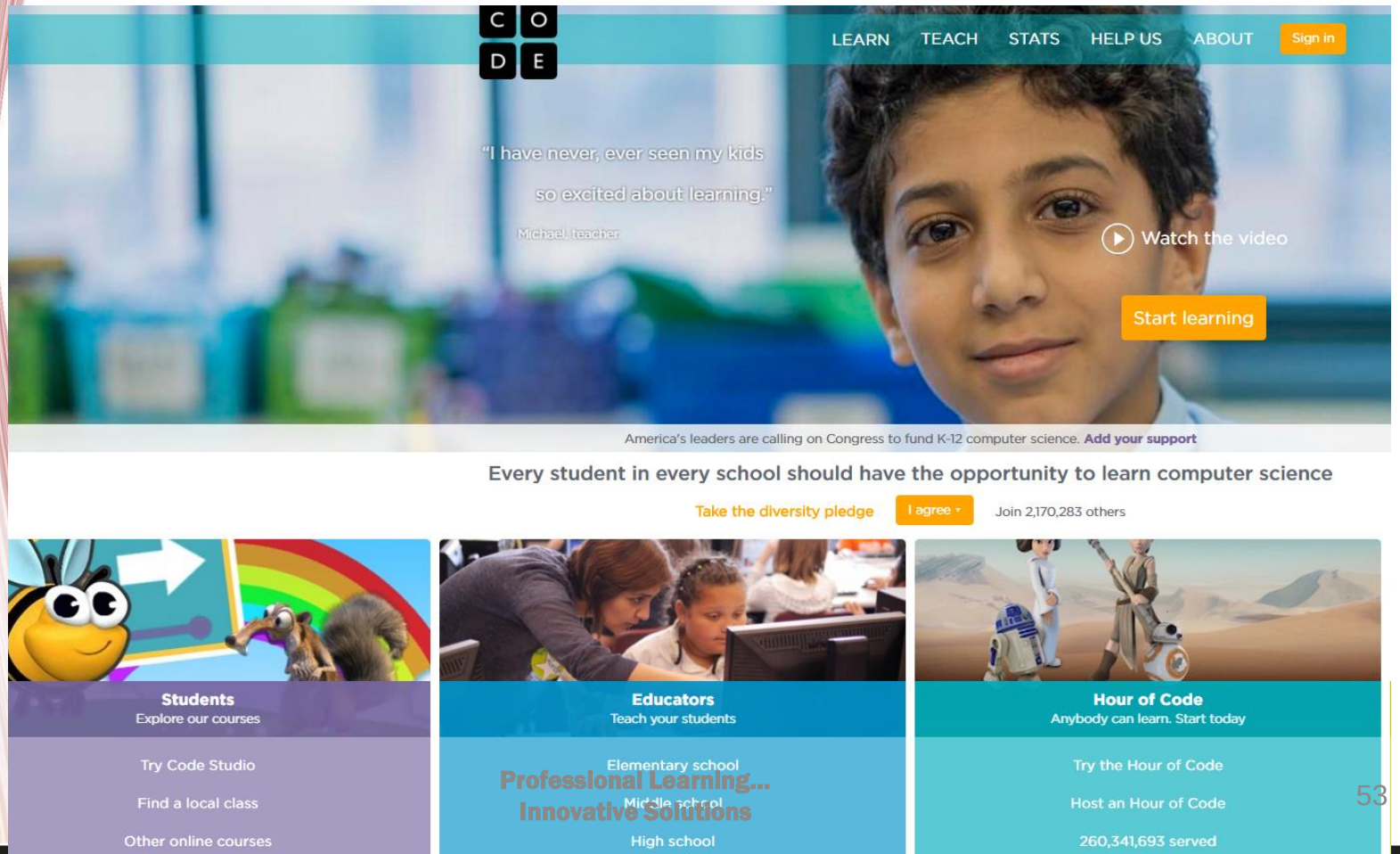
- Rollin' Rollin' Rollin'
  - Focus question: How can we make the ball roll in different directions?

Forces and Interactions 3-PS2-1

How does force impact an object?

Coding

- www.code.org



Coding

- http://www.sphero.com/sprk-plus
- 

OSMO

- Tangrams---observation
- Words
- Coding
  https://www.playosmo.com/en/

AR, VR, QR

- Augmented Reality
- http://elements4d.daqri.com/
- Virtual Reality
- http://www.cnn.com/2016/01/07/health/google-cardboard-baby-saved/
- Google Cardboard
- Quick Response

Quick Response

- Fold a piece of paper into fourths
- Number each section (or use sticky notes)
- Use a QR code reader to take you to the picture
- Draw or describe what you see in each picture
- In the fourth section summarize what you have learned about owls

Augmented reality (AR) is a technology that layers computer-generated enhancements atop an existing reality in order to make it more meaningful through the ability to interact with it. AR is developed into apps and used on mobile devices to blends digital components into the real world in such a way that they enhance one another, but can also be told apart easily.

What is Virtual Reality?

Virtual reality (VR) is an artificial, computer-generated simulation or recreation of a real life environment or situation. It immerses the user by making them feel like they are experiencing the simulated reality firsthand, primarily by stimulating their vision and hearing.

Forces and Interactions

- Elements 4D—the paper cubes/iPads Augmented Reality
- http://elements4d.daqri.com/

Quiver

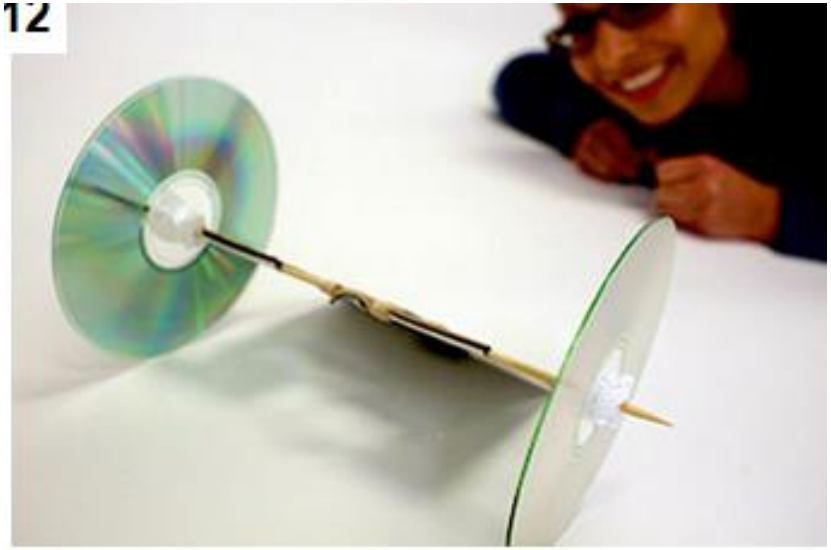
- www.quivervision.com

QuiverVision

Education
Starter Pack

Energy
4-PS3-4

- http://pbskids.org/designsquad/build/rubber-band-car/
- What questions could you explore?



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_____.

Waves and Sound

- Augmented Reality
- https://www.youtube.com/watch?v=B3SzvIKoRgE

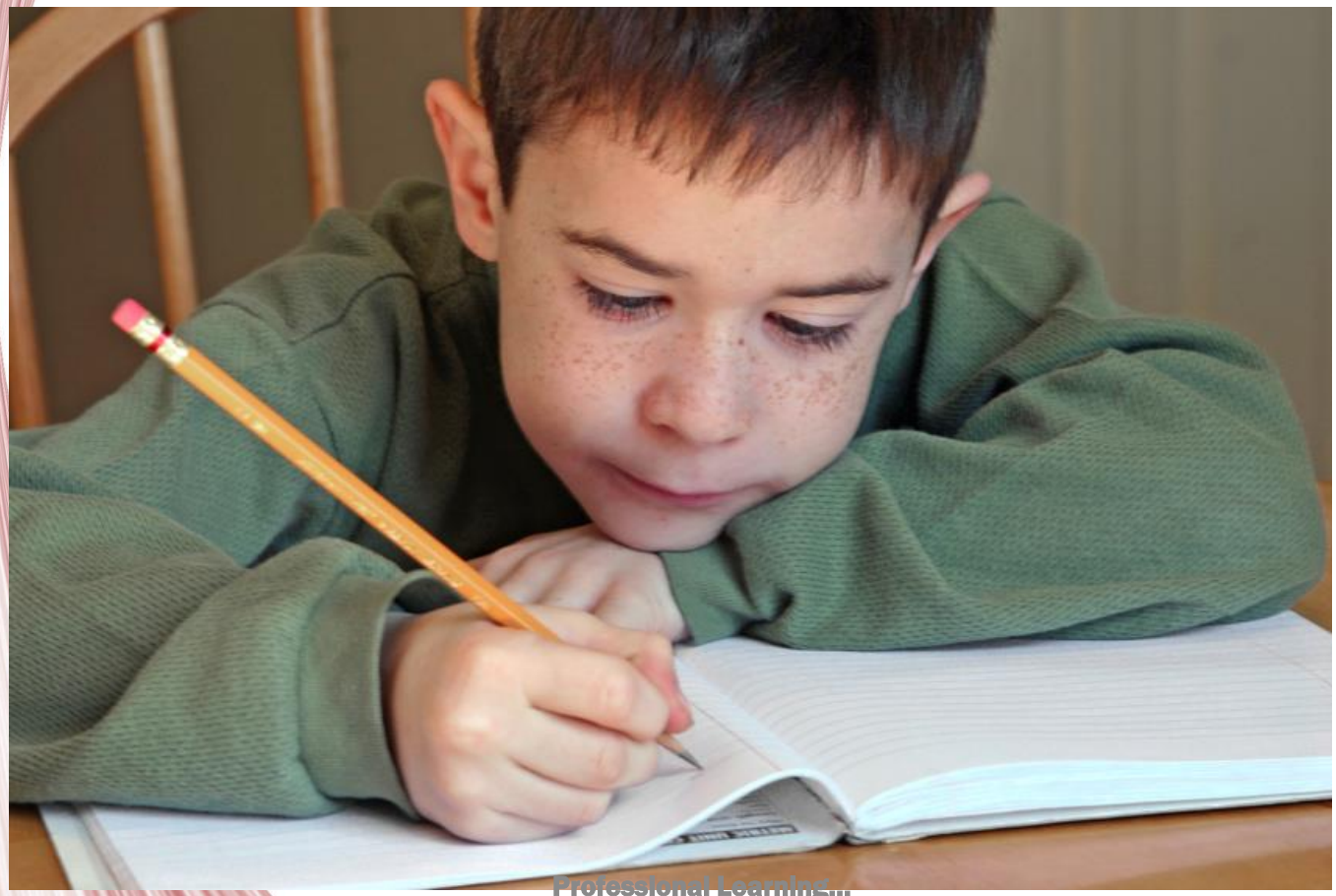
- Enchantium: Musical Strings

- https://www.youtube.com/watch?v=uKUM_7mkww8 Mind Power

Listen to your students

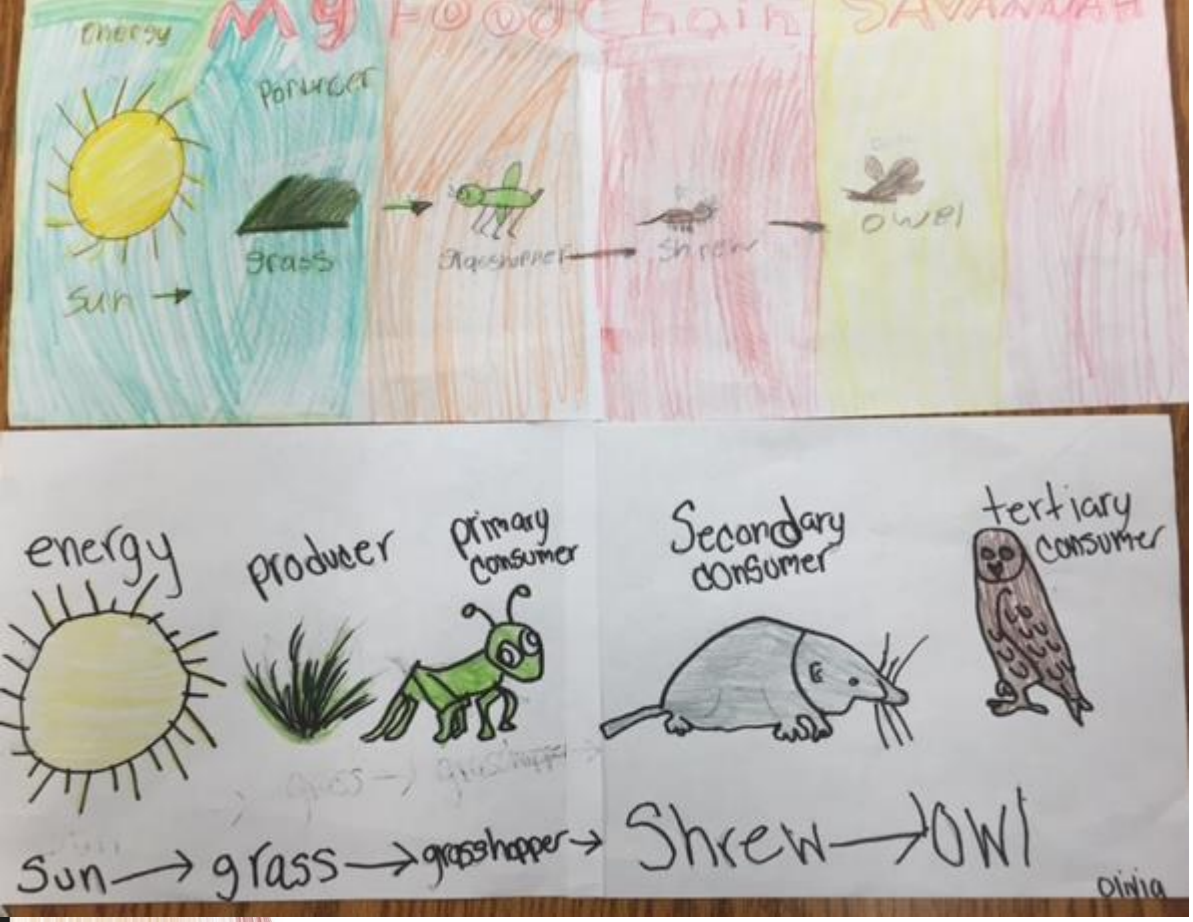
- What is a bird's favorite color?

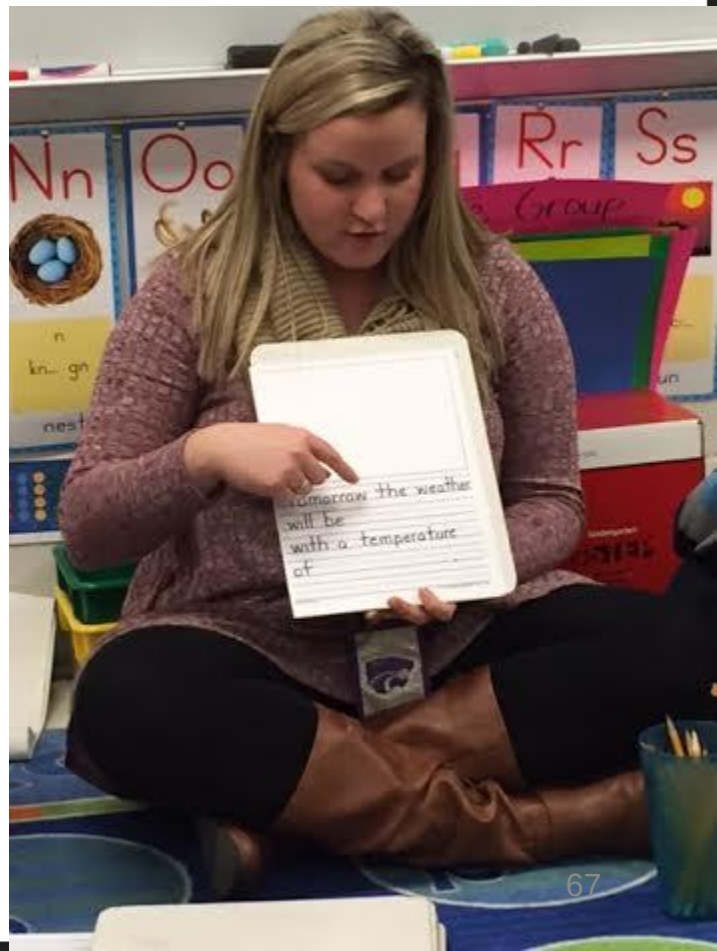
What about ELA??



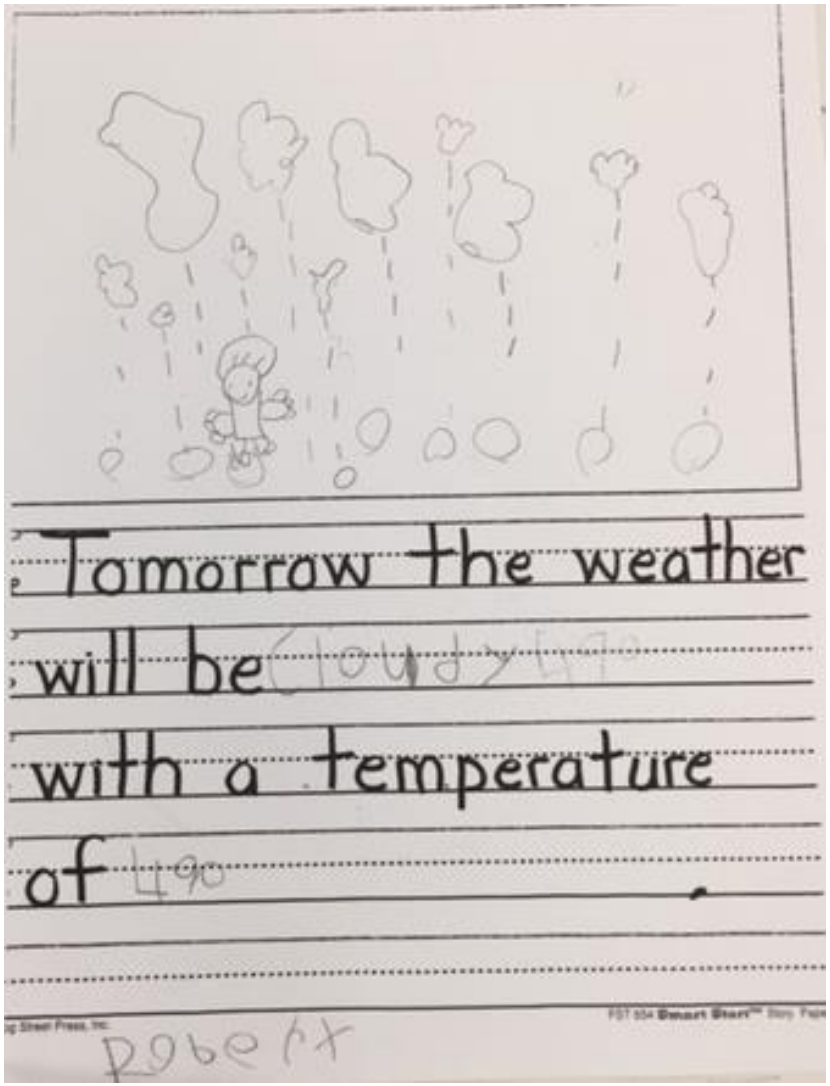
CCRS—ELA Grades K-5

- 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.


energy
producer
primary consumer
Secondary consumer
tertiary consumer
Sun → grass → grasshopper → Shrew → Owl
Olivia


Nn
Oo
Rr
Ss
Group
Tomorrow the weather will be
with a temperature of


Ll Mm Nn Oo Pp Rr Ss Tt Uu Vv Ww Xx Yy Zz


Tomorrow the weather
will be cloudy
with a temperature
of 49°
Robert

HGSS (Social Studies)

- Benchmarks
  - 3.2 The student will draw conclusions about significant beliefs…and ideas, analyzing the origins and context under which these competing ideals were reached and the multiple perspectives from which they come.
  - 4.4 The student will use his/her understanding of continuity and change to construct a model for contemporary reform

Other comparisons to CCRS ELA

- Which S&E Practice aligns with…

- Ask and answer questions
- Speaking and listening
- Close reading
- Writing of any type

As you design lessons

- Refer to 5 E Lesson Plan Form: Engage, Explore, Explain, Elaborate, Evaluate
- Or think:
  - Gathering/Reasoning/Communicating
- Start with a focus question
- Plan for discussion and writing
- MODEL—Model—*Model*--***MODEL***
- Scaffold but remove scaffolding eventually

Plan to use scaffolding

- Provide sentence stems prior to the communication stage
- Allow students to TALK before they write
- Provide word banks for reference
- Always remember to remove the scaffolding as appropriate

Ask questions…

- Start with a focus question.
- What evidence do you have?
- What data from your investigation would support your claim?
- What question would a scientist ask?
- What words would a scientist use?
- What other questions could we ask?

Get students to ask questions

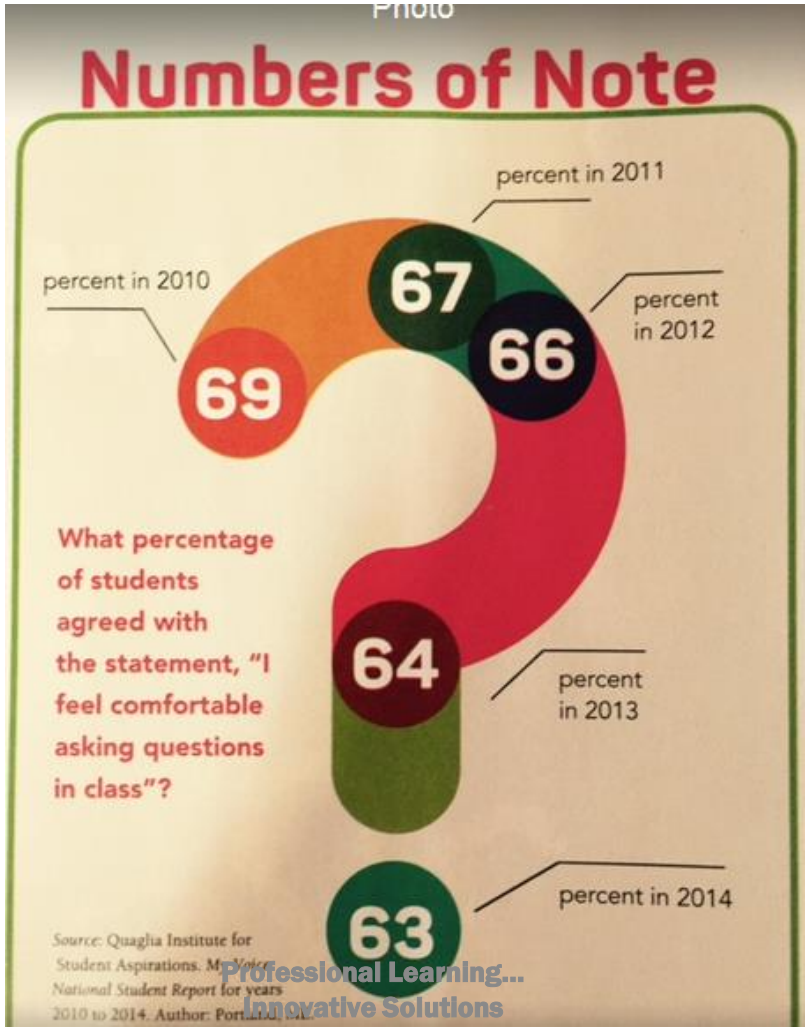
- Asking questions turns students into critical thinkers
- When students ask questions, we get a better sense of their true understanding
- When students ask questions, they are more engaged in their learning

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?

Take a closer look

- Appendix F Science and Engineering Practices
- http://www.nextgenscience.org/next-generation-science-standards

- Compare to Mathematical Practices

Science and Engineering Practices

- 1. Asking questions (for science) and defining problems (for 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 (for science) and designing solutions (for engineering)
- 7. Engaging in argument from evidence
- 8. Obtaining, evaluating, and communicating information

Mathematical Practice

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Take a close look

- Appendix E---Progressions
- http://www.nextgenscience.org/sites/ngss/files/Appendix%20E%20-%20Progressions%20within%20NGSS%20-%20052213.pdf
- Tables come to consensus:

Three things you noticed.

Three things you infer.

Three things you predict.

One question you have!!!!

Create a T-Chart (Gallery Walk)

Similarities: Math and Science	
Math	**Science**

Round Robin Writing

Groups of three

One paper that will be passed around

Each has a different colored pencil

Should we allow repeats?

- What I know about the Crosscutting Concepts

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"

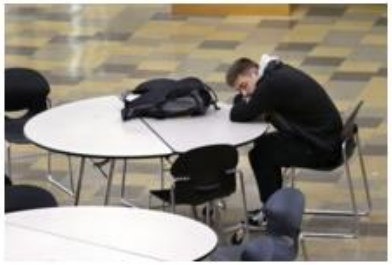
tweentribune

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

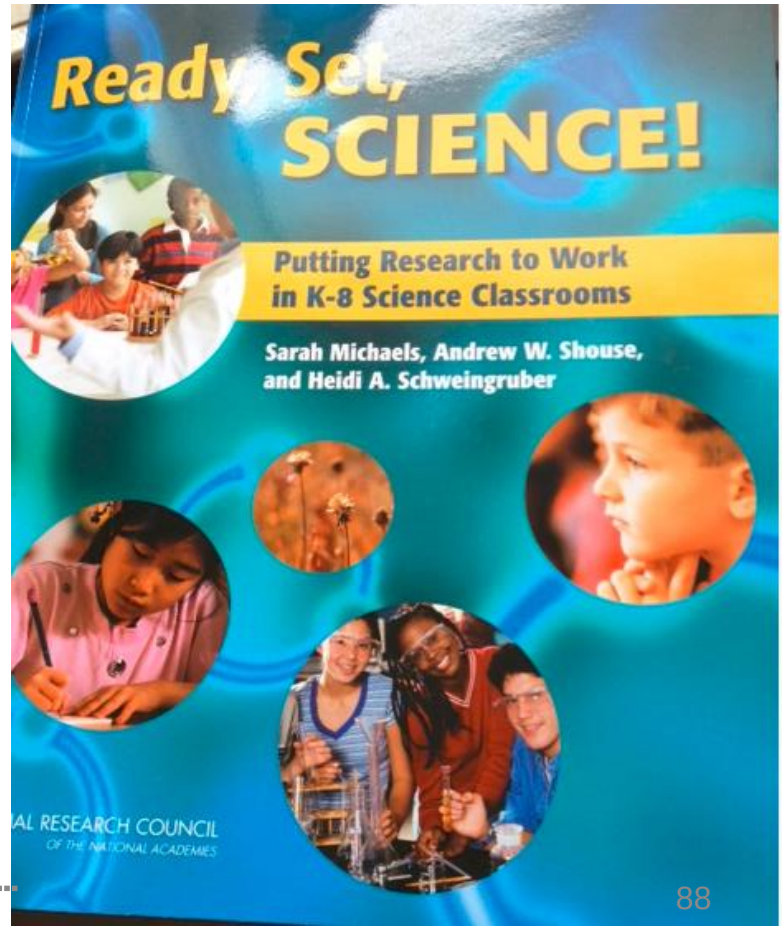
This set of lesson provides ideas for a study of the art

TEACHER RESOURCES

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

Suggested Materials

- Ready Set Science



Translating the NGSS for Classroom Instruction

http://learningcenter.nsta.org/files/PB341Xweb.pdf (part of it)

Read Works

ReadWorks.org
The Solution to Reading Comprehension

Lessons & Units | Reading Passages | About ReadWorks

Lesson Plans
- Skill & Strategy Units
- Comprehension Units
- Novel Study Units
- Reading Passages

FEEDBACK
HELP

READWORKS
Reading Passages on Science Topics

Print Share now!

REGISTER NOW
• FREE unlimited access to reading passages and lessons
Register a free account >>

Picture books for science

- http://www.magnet.fsu.edu/education/community/scienceinliterature/picturebooks.html
- http://www.pinterest.com/mommasharn/science-picture-books/

Lesson Plans

- http://www.resa.net/curriculum/curriculum/science/professionaldevelopment/ngss-pd/lesson-plans-exploring-ngss/
- http://ngexplorer.cengage.com/ngyoungexplorer/calendar.html
- National Geographic free books
- http://ngexplorer.cengage.com/ngyoungexplorer/readstory.html

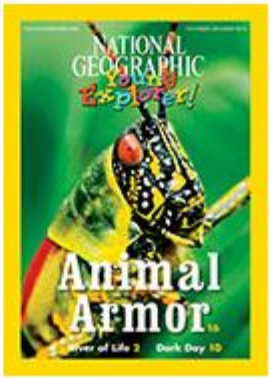
NATIONAL GEOGRAPHIC Young Explorer!

Home | Read the Story | For Teachers | More Issues | Story Calendar | Subscribe | NG Explorer

NATIONAL GEOGRAPHIC Young Explorer!

Story Calendar

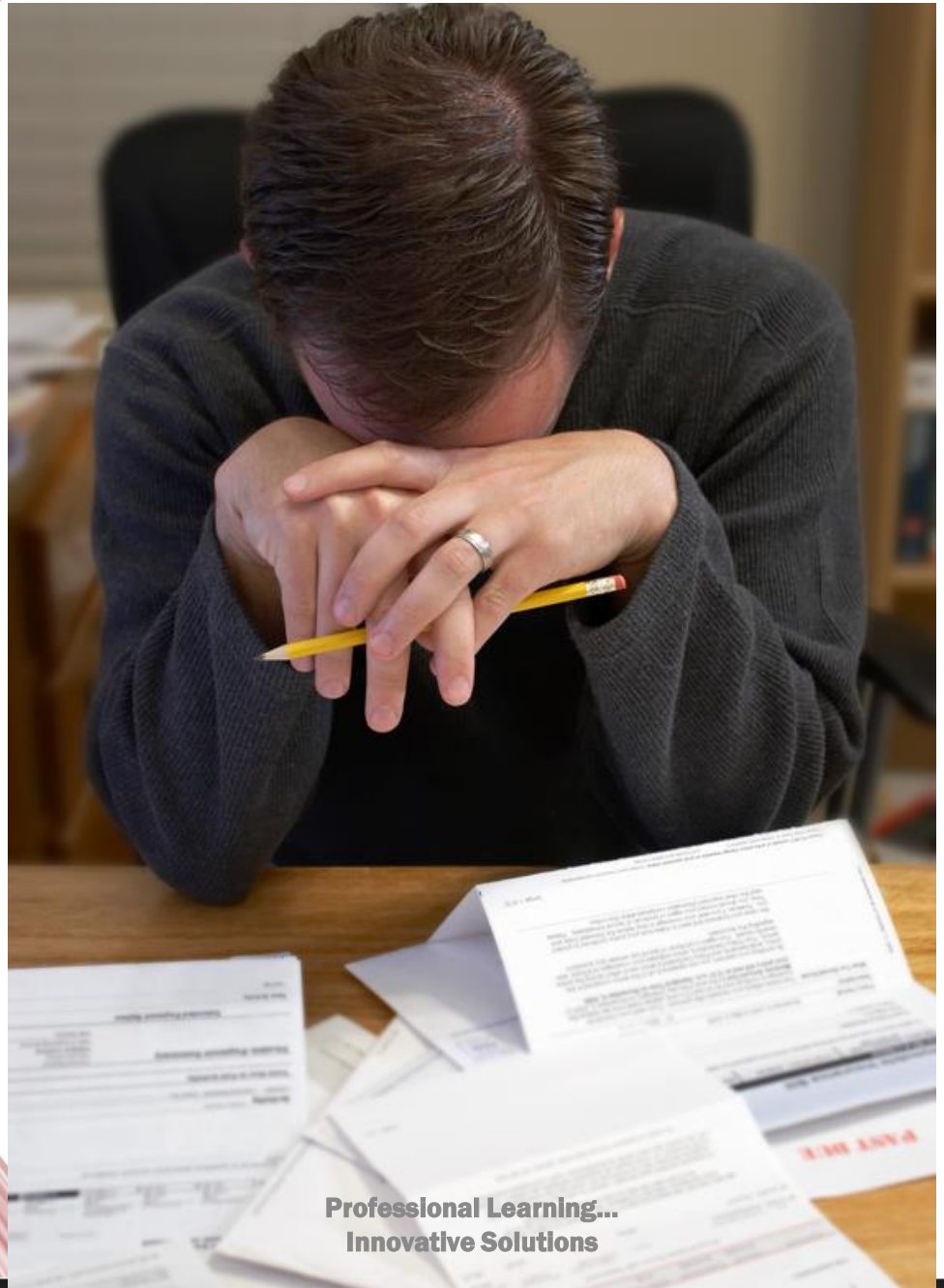
This editorial calendar for 2014-2015 will help you integrate the standards covered in National Geographic Young Explorer into your curriculum.



Month	Topic
SEPTEMBER	Seasons Sorting Living and Nonliving
OCTOBER	Pushes and Pulls Effects of Sunlight What Living Things Need
NOVEMBER/DECEMBER	Illumination Weather Parents/Offspring

Pinterest—before you laugh

- http://www.pinterest.com/pin/315040936405192676/



From ***Ready Set Science***

- **“This ability to evaluate knowledge in relation to new information or alternative frameworks and to alter ideas accordingly is a key to scientific practice.”**

- National Research Council of the National Academies 2001

- **How is this different from *<u>any</u>* content**?

Share Ideas

- Resources
- Blogs
- Websites
- Apps
- Other???????

Continue Learning

- **Join National Science Teachers Association (or share a membership)**
- **Follow a blog**
- **Read a book**
- **TRY SOMETHING NEW**

http://www.edutopia.org/blog/websites-for-science-teachers-eric-brunsell

edutopia™ Browse Topics ▾ | Watch Videos ▾

July 13, 2014 | TRENDING: Myth-Busting Differentiated Instruction Search

NEW TEACHERS

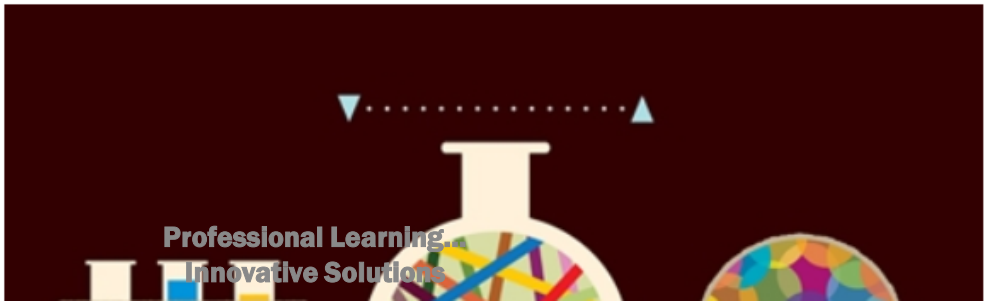
Ten Websites for Science Teachers

FEBRUARY 7, 2012

Like 865 Tweet 771 Pin it 213 Share 639 20

Eric Brunsell

Asst Professor of Science Education @ UW-



More Ideas

- http://alpha.projectmash.org/do/projects
- https://tuvalabs.com/datasets/in/energy/?category=energy
- Project MASH is a social learning experience that challenges teachers and students to DESIGN stuff, MAKE stuff, and PLAY stuff, to ACT and WRITE, CREATE and EXPLORE. PROJECT MASH bridges the divide between learning in and out of school, from making and tinkering in the classroom to citizen science in the backyard.

Exit Cards

- Make a commitment of one thing you will do this semester.

Thank you for coming today!

- Making Science Fit teach our students to observe, think, draw conclusions, and communicate!