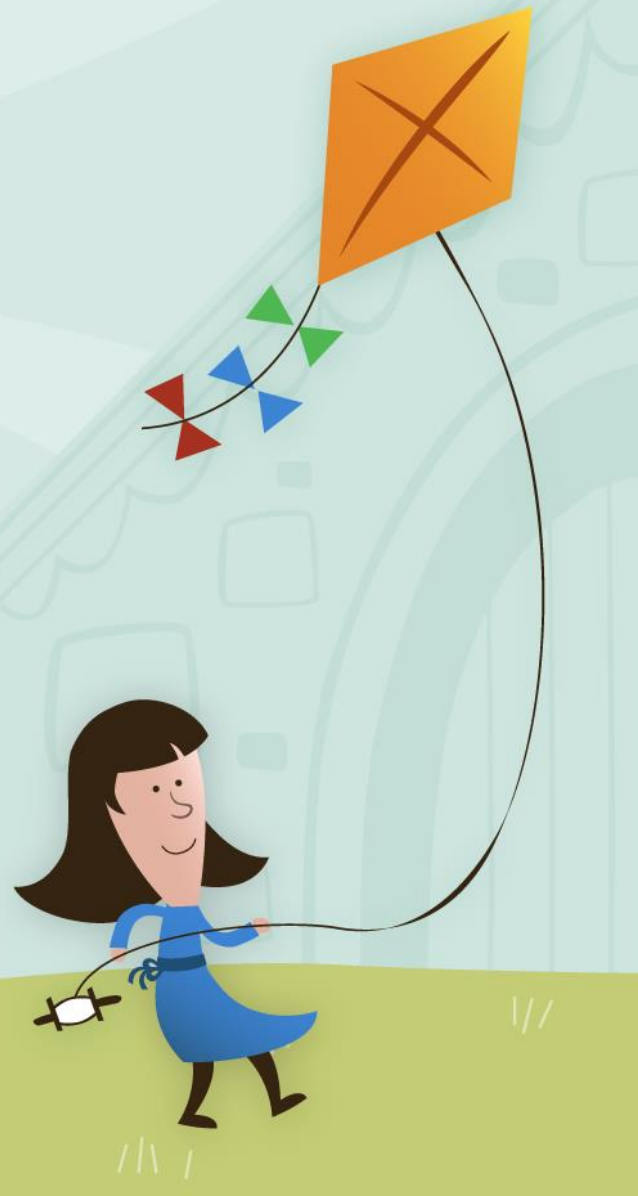
Science in Kindergarten

Transitioning to the NGSS

Vickei Hrdina

Regional Science Coordinator



Goals and Agenda

- Become familiar with the content and organization of the Kindergarten NGSS Standards
- Immersion into 3D teaching to support NGSS in each science kit
- Connections to support integrating science with Common Core

Agenda

- Overview of NGSS in Kindergarten
- Common Core connections – writing in science
- Engineers and Scientists
  - Weather & Climate
- Lunch and Materials Management
- Arguing from Evidence and Using Models
  - Animals 2 x 2
- Data Collection and Analysis – Common Core math
  - Push Pull Go!

Today's Activities

Are…

- An attempt at 3-Dimensional instruction
- A model of a process or set of strategies
- Adaptable to any curriculum, any kit, any OER

Are <u>not</u>…

- The perfect example, or the only strategy of 3-Dimensional instruction
- An activity to be done with 'fidelity' – you are encouraged to change/adapt/modify to your students' needs

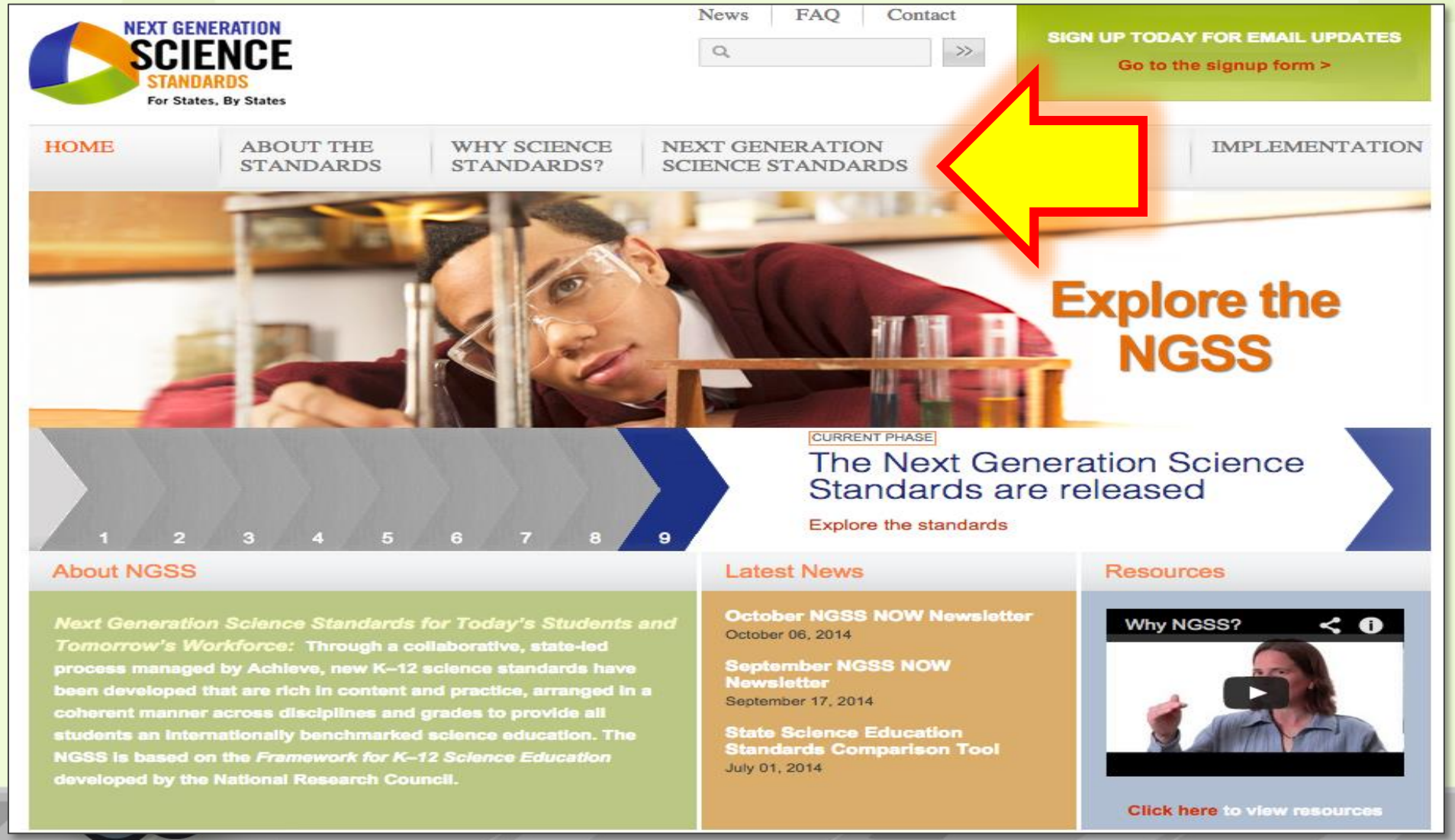
The Next Generation Science Standards

What’s new…

What’s different?...

What’s so different about the NGSS?

Accessing the NGSS: www.nextgenscience.org



There's an APP for that!!

2-PS1 Matter and its Interactions

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Students who demonstrate understanding can:

2-PS1-1. Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties. [Clarification Statement: Observations could include color, texture, hardness, and flexibility. Patterns could include the similar properties that different materials share.]

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 measurements is limited to length.]

2-PS1-3. 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. [Clarification Statement: Examples of pieces could include blocks, building bricks, or other assorted small objects.]

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- Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question. (2-PS1-1)

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)

Constructing Explanations and Designing Solutions
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Engaging in Argument from Evidence
Engaging in argument from evidence in K–2 builds on prior experiences and progresses to comparing ideas and representations about the natural and designed world(s).
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Connections to Nature of Science

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- Scientists search for cause and effect relationships to explain natural events. (2-PS1-4)

Disciplinary Core Ideas

PS1.A: Structure and Properties of Matter
- Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature. Matter can be described and classified by its observable properties. (2-PS1-1)
- Different properties are suited to different purposes. (2-PS1-2),(2-PS1-3)
- A great variety of objects can be built up from a small set of pieces. (2-PS1-3)

PS1.B: Chemical Reactions
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Crosscutting Concepts

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Connections to other DCIs in second grade: N/A

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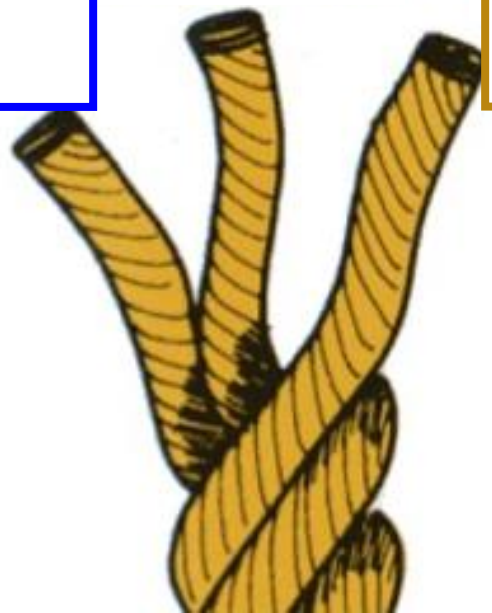
DISCIPLINARY CORE IDEAS (DCI's)

SCIENCE AND ENGINEERING PRACTICES (SEP's)

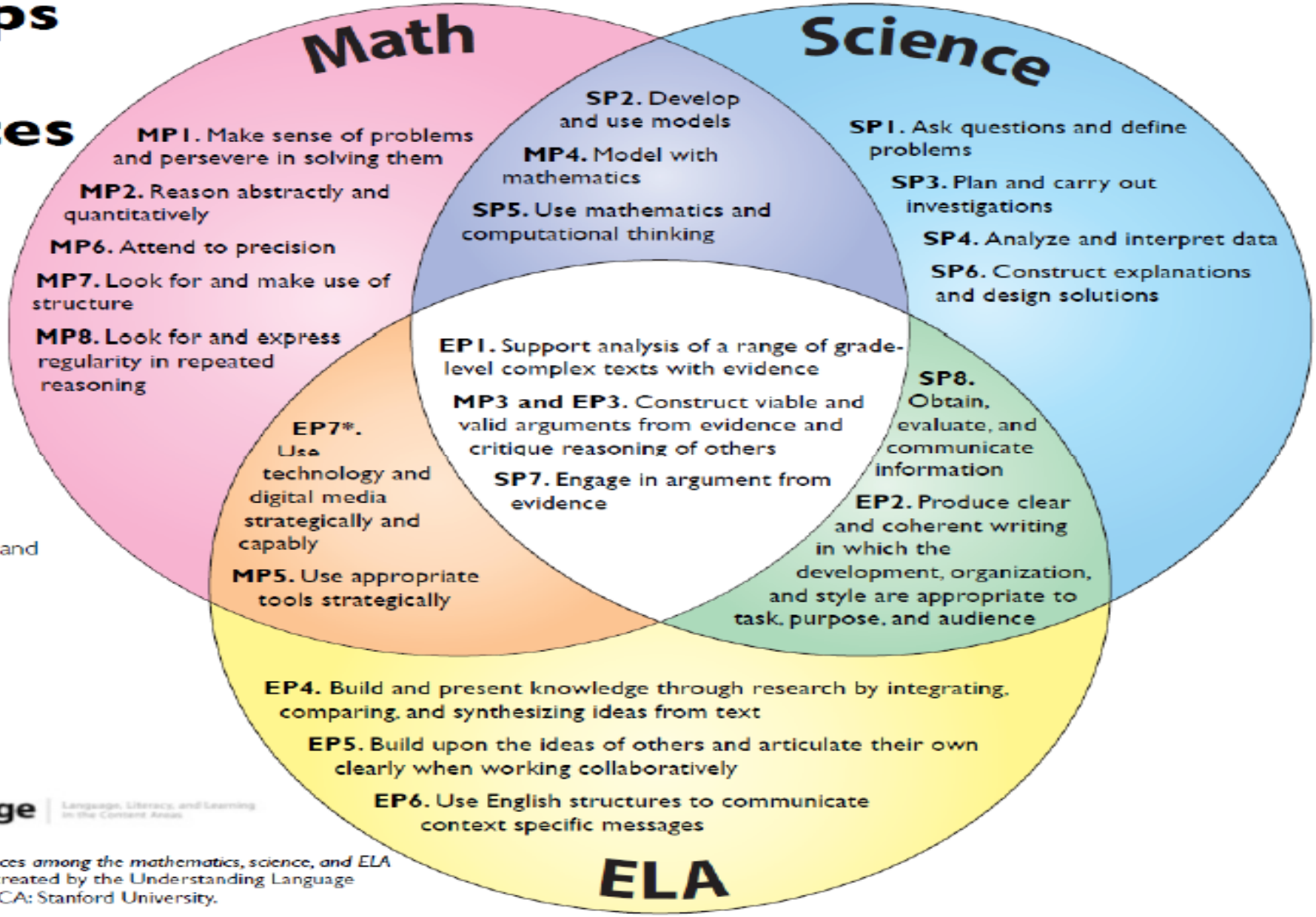
CROSSCUTTING CONCEPTS (CC's)



Relationships and Convergences

Found in:
1. CCSS for Mathematics (practices)
2a. CCSS for ELA & Literacy (student capacity)
2b. ELPD Framework (ELA "practices")
3. NGSS (science and engineering practices)

Notes:
1. MP1–MP8 represent CCSS Mathematical Practices (p. 6–8).
2. SP1–SP8 represent NGSS Science and Engineering Practices.
3. EP1–EP6 represent CCSS for ELA "Practices" as defined by the ELPD Framework (p. 11).
4. EP7* represents CCSS for ELA student "capacity" (p. 7).



Stanford
GRADUATE SCHOOL OF EDUCATION

Understanding Language | Language, Literacy, and Learning in the Content Areas

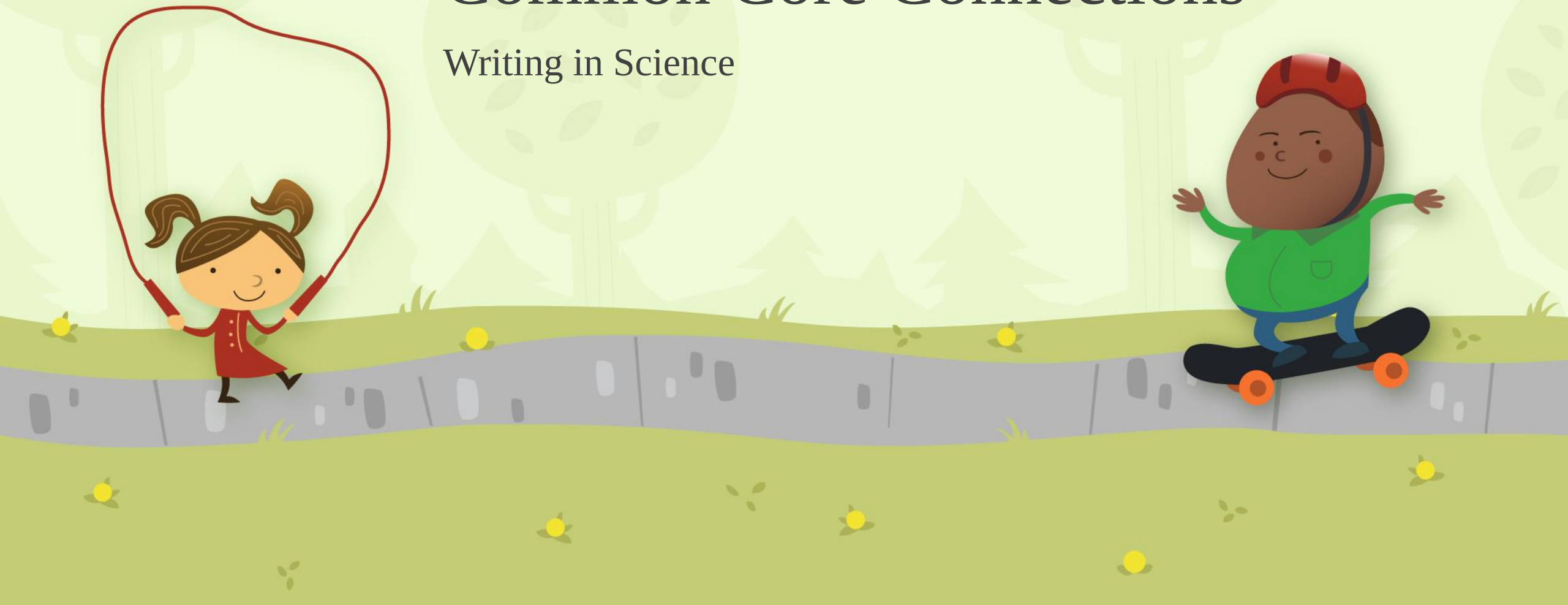
Suggested citation:
Cheuk, T. (2013). *Relationships and convergences among the mathematics, science, and ELA practices.* Refined version of diagram created by the Understanding Language Initiative for ELP Standards. Stanford, CA: Stanford University.

Beyond Science Activities

- Activities, no matter how good (“hands-on”) are not enough!!!
- Integration of science ideas, practices and crosscutting concepts is essential for meaningful science learning (see NAP Framework document)
- Activities should be a vehicle for…
  - Engaging and explaining phenomena
  - Collecting data to analyze and construct arguments
  - Test ideas and explanations
  - Design solutions to authentic problems

Common Core Connections

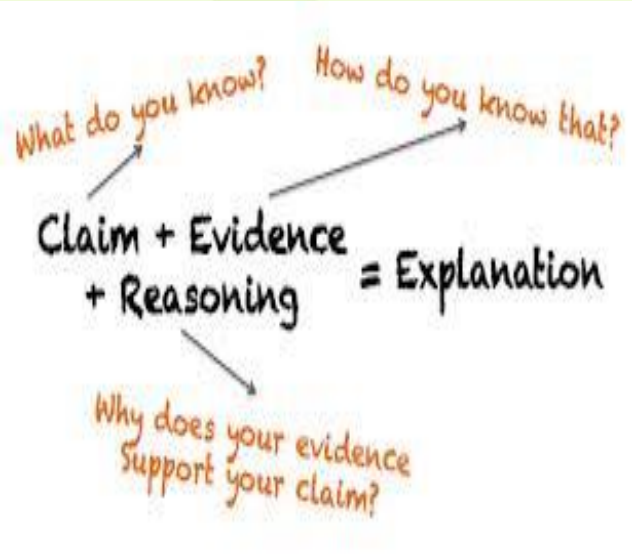
Writing in Science



The CCSS Requires Three Shifts in ELA/Literacy

- Building knowledge through content-rich nonfiction
- Reading, writing and speaking grounded in evidence from text, both literary and informational
- Regular practice with complex text and its academic language

Reading, Writing and Speaking Grounded in Evidence from Text: Why?



- Most college and workplace writing requires evidence.
- Evidence is a major emphasis of the ELA and Literacy in History/Social Studies Standards
- Ability to cite evidence differentiates strong from weak student performance on NAEP.
- Being able to locate and deploy evidence are hallmarks of strong readers and writers.

Why Use Science Notebooks?

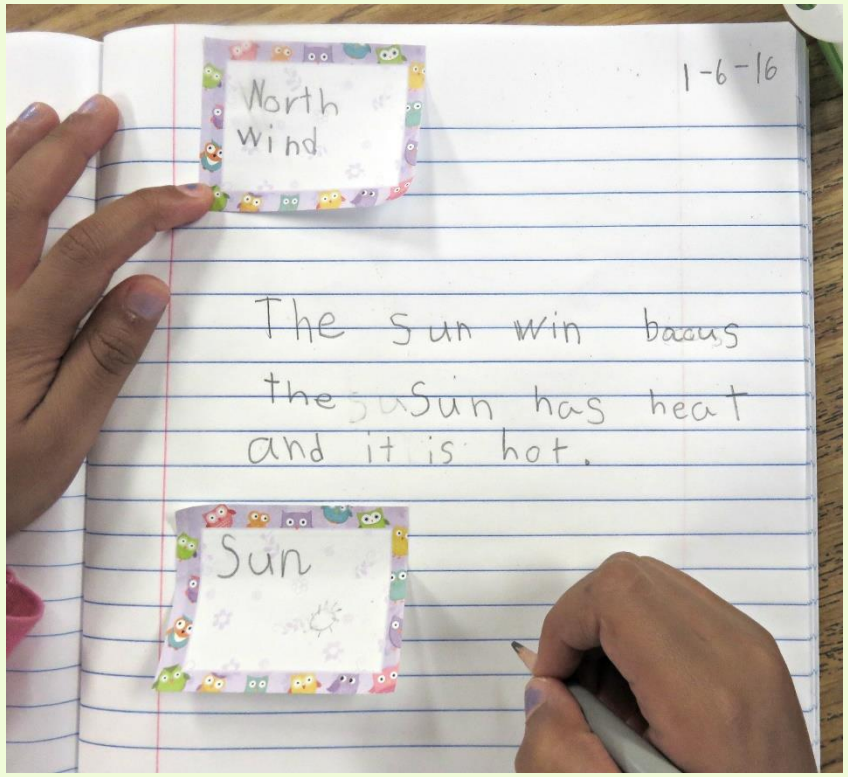
1. Documentation
2. References
3. Engagement
4. Integration
5. Assessment
6. Feedback
7. Discussion

- Organization in Primary:
  - Page Numbers
  - TOC – documentation
- Optional:
  - Glossary

Notebooking in Science

Requirements for all students' science notebooks:

1. Date, in numerals, the first page of the entry
2. Focus or investigation question for each lesson
3. Write something about each science experience
4. Best handwriting at all times



Science and Scientific Writing

Science Session

- At the beginning of ‘science time’ students take out their notebooks and write the date.
- Engage and discuss in what today’s investigation will focus on
- During the investigation, students minds are focused on the task
  - If they need to record data, build in a pause
  - If they need to draw or make diagrams, make it toward the end of the session

Writing

- Shared reflection as a group follows the science session – partner talk, class data charts
- Students all have their notebooks on hand
- Have concrete materials nearby
- Teacher asks guiding questions – prompts discourse, add words to word bank
- Individual reflection – applying the thinking to the focus question, writing with sentence stems or drawing and labelling

Engineers and Scientists

Weather and Climate

Engineering is Problem Solving

In the struggle, there are multiple pathways for student success…

FAIL FAST>>>SUCCEED SOONER!!

What is the problem we are trying to solve? What criteria do we need to meet? Do we have any constraints?

Define

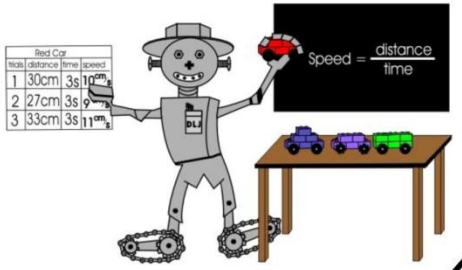
- Brainstorming.
- Initial ideas and modeling (sketches, diagrams).
- Researching

Develop Solutions

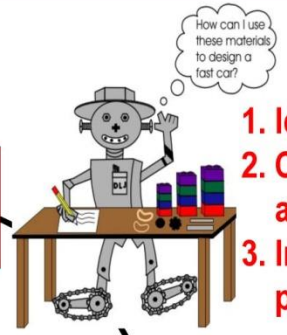
Optimize

- Multiple solutions compared to criteria and constraints.
- Making trade-offs.
- Modifying designs based on data from testing.

Jamerson Engineering Design Process

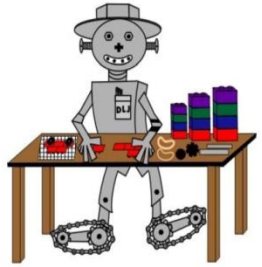


Plan



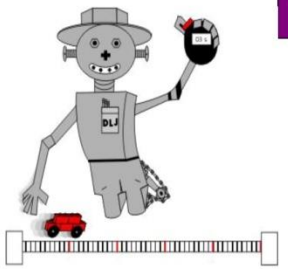
1. Identify the design problem.
2. Clarify the design limitation and requirements.
3. Investigate (research) the problem.

Design



1. Generate design alternatives.
2. Choose the best option and explain why.
3. Develop a design model or prototype.

Check



1. Test and evaluate the design solution.
2. Modify the design to meet developing needs.

Share

1. Communicate achievements.

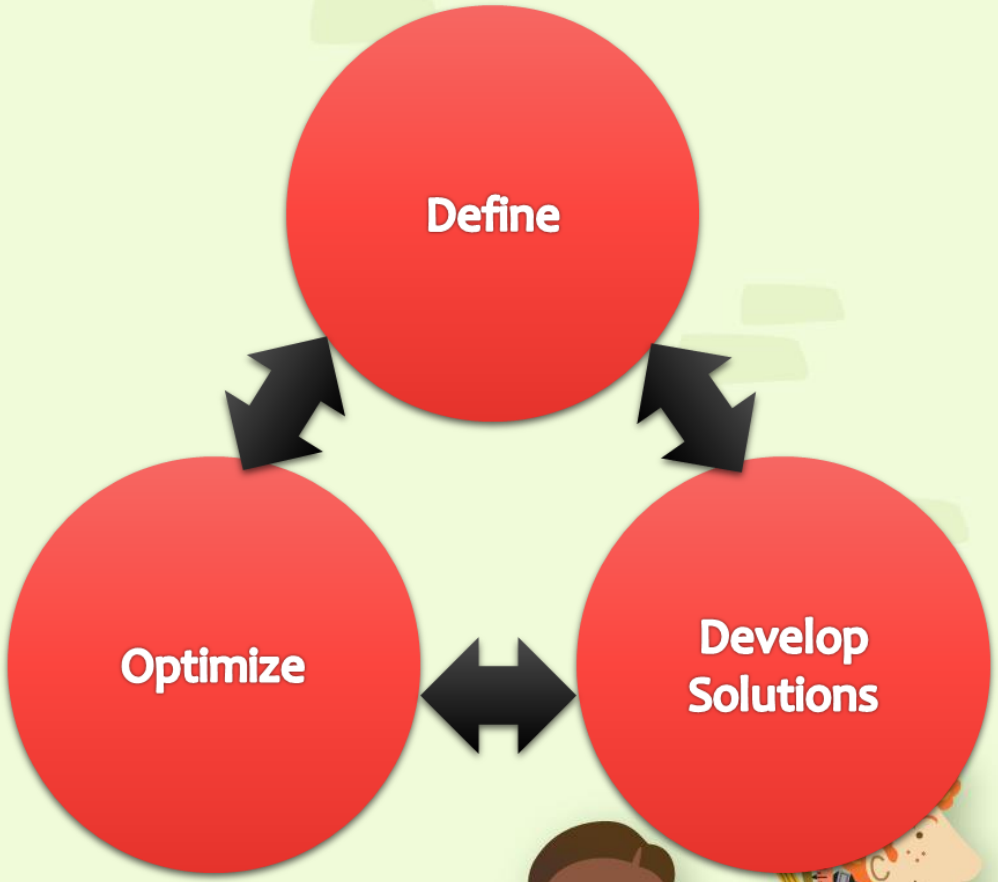
DOUGLAS L. JAMERSON, JR. ELEMENTARY Center for Mathematics and Engineering

What NGSS Says About What Students Should Know and Be Able to Do…

Examine the description of Engineering Design at your grade level in Appendix I from the NGSS.

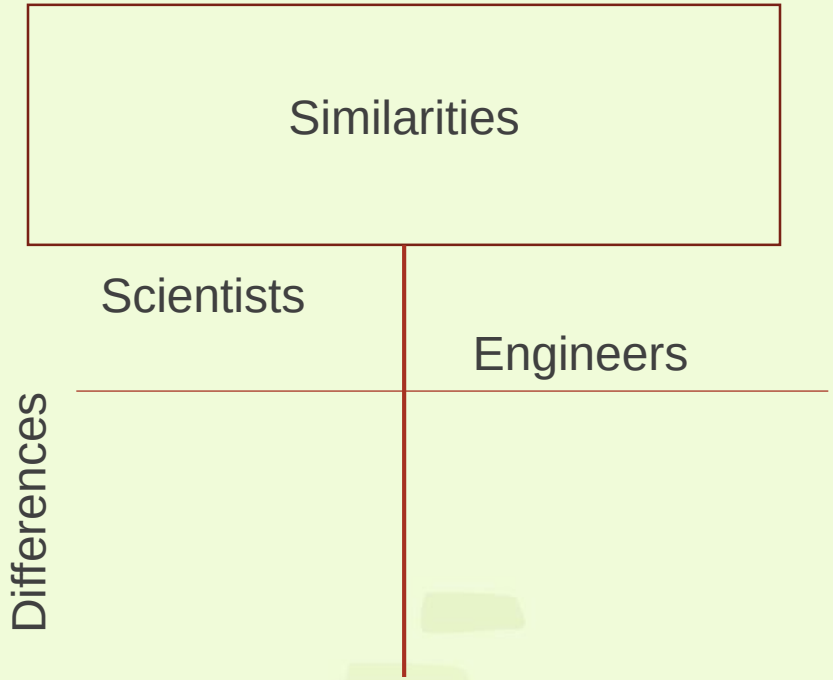
At each stage of the design process, what should students in your grade level know and be able to do?

Jot your thoughts onto the placemat.



Box and T Chart

- What are the similarities in the work that scientists and engineers do?
- What are the differences?

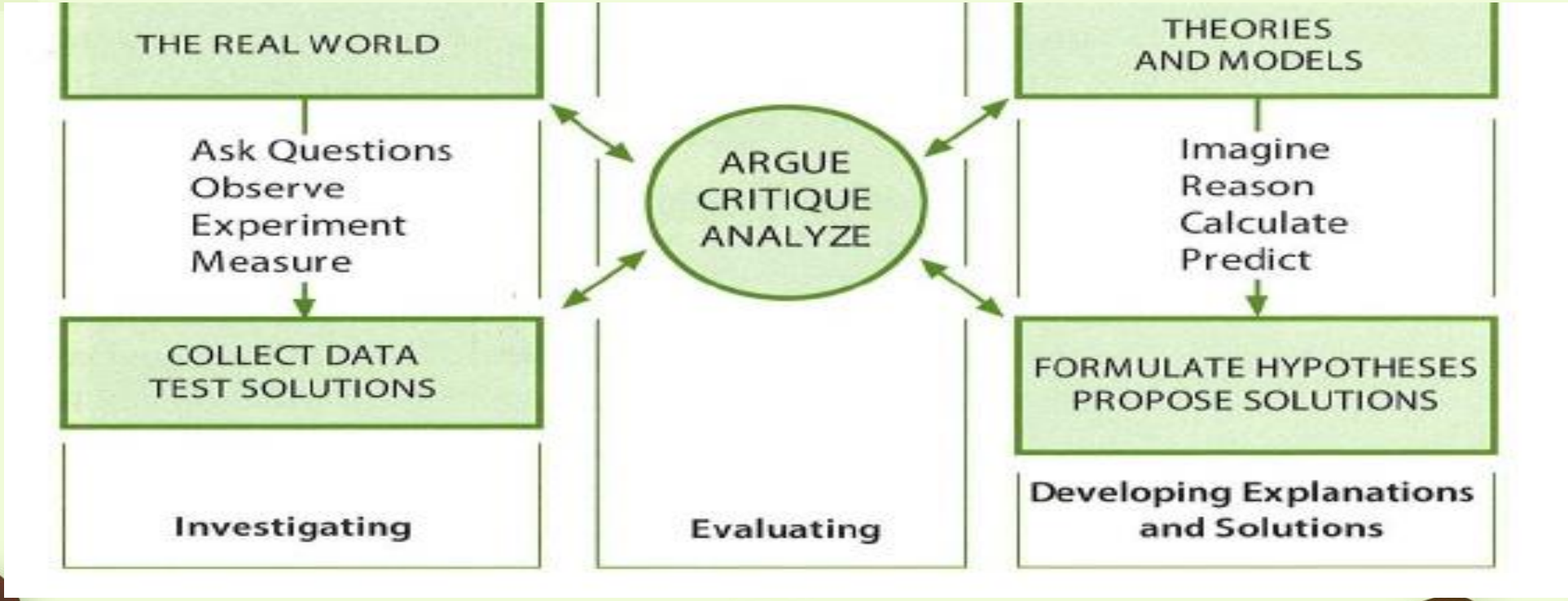


Activity Sort

- Sort the activities onto your placemat.
- Which cards might fall into the work of scientists?
- Which cards might be the work of engineers?
  - What about inventors?
- Which practices do they go with?

How would you summarize the work of scientists, engineers and inventors?

Spheres of Activity For Scientists and Engineers



http://youtu.be/oc1iIRKZE9w

Whew! …Time for a Break!

Focus Idea: What is a scientist, an engineer and an inventor?

- Examine the lesson plan and game materials
- Determine where you see kids using the SEPs – note which ones you see in BLUE
- Determine how kids are using the CCCs – note which <u>one</u> is the most obvious connection
- <u>How can you change the focus question to reflect the CCC?</u>

Which response best reflects how you have taught weather in K?

A. Water cycle lesson

B. Identify different types of weather – add to calendar

C. Dressing/preparing for local weather

D. Using daily weather to make predictions

E. Weather not taught in K

F. Other

Go to **www.govote.at** and use the code **31 10 77**

Made for the Shade

Define

- Like many creatures, including humans, this special creature is affected by the temperature it lives in. This creature prefers shady and cool spots and because of that it's very shy to come out.
- Your challenge is to design a home for our pets. Your design must include a front door and it must protect our new friend from the sun.
- You may only use the materials that I give you.

Defining the Problem

Criteria

- Specifications
- Requirements
- Known at the start
- Measure of success
- Typically positive language

Constraints

- Limitations or rules (time, materials, people)
- May be revealed during design
- Always subject to change
- Typically negative language

Materials

- Large thick paper plate (base) – 1 per student
- Small paper cups – 4 per student
- Craft sticks
- Roof materials
  - o Construction paper (variety of colors)
  - o Cardboard
  - o Aluminum foil
  - o Wax paper
  - o Felt
  - o Clear plastic sheets
- Sunscreen (SPF 8, 30, 50)
- Tape/glue/glue sticks
- Markers/crayons/colored pencils

Brainstorming

- Opportunities for integration of science, social studies and ELA
- Whole class brainstorming
- Individuals draw and label their choices for design, then collaborate with a small group (2-3) to decide on the best design.
- Notebook (writing session) to capture formative assessment data

Develop Solutions

Testing Procedure

Optimize

- Opportunity to Tech-Up the investigation by using the Go-Temp probes
- Let’s take our pets outside and gather some data
- How do you manage the optimization phase in Engineering?

K-PS3-2 Energy

Students who demonstrate understanding can:

K-PS3-2. **Use tools and materials provided to design and build a structure that will reduce the warming effect of sunlight on Earth's surface.*** [Clarification Statement: Examples of structures could include umbrellas, canopies, and tents that minimize the warming effect of the sun.]

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Constructing Explanations and Designing Solutions	PS3.B: Conservation of Energy and Energy Transfer	Cause and Effect
Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions. • Use tools and materials provided to design and build a device that solves a specific problem or a solution to a specific problem.	• Sunlight warms Earth's surface.	• Events have causes that generate observable patterns.

Connections to other DCIs in kindergarten:
K.ETS1.A ; K.ETS1.B

Articulation of DCIs across grade-levels:
1.PS4.B ; 2.ETS1.B ; 4.ETS1.A

Common Core State Standards Connections:

ELA/Literacy -

W.K.7 Participate in shared research and writing projects (e.g., explore a number of books by a favorite author and express opinions about them). *(K-PS3-2)*

Mathematics -

K.MD.A.2 Directly compare two objects with a measurable attribute in common, to see which object has "more of"/"less of" the attribute, and describe the difference. (K-PS3-2)

CCSS- W.K.7 Participate in shared research and writing projects.

Scaffolding and Cascading New Science Information

- Where would you place this lesson in a unit on Weather and Climate?
- Taking a look at the standard page – what learning opportunities might need to come before or after this lesson?

- Kindy Weather and Climate CCSS Based unit

Key content criteria in the unit

- Identify attributes of weather
- Describe temperature and how to measure it
- Reading a thermometer
- Recording temperatures
- Obtain other sources of daily temperature & weather
- Ask a scientist (meteorologist)

http://learningcenter.nsta.org/mylibrary/collection.aspx?id=JgCeRXLCg9I_E

- Critter Ordering for Life Science
  - Must be done 2 weeks ahead of requested delivery
- FOSSWeb Teacher Prep videos
  - **Activation Code: AME2EL4898**
- Kit Management Issues:
  - Animals 2 x 2

Constructing Explanations

Animals 2 x 2

How to read the standards »

K-LS1-1 From Molecules to Organisms: Structures

Students who demonstrate understanding

K-LS1-1. **Use observations to des**

Statement: Examples of

needed by differe

Clarification

kinds of food

The performance expectation

cation:

Analyzing and Interpreting Data

Analyzing data in K–2 builds on prior expe

progresses to collecting, recording, and shar

observations.

- Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions.

grow.

atural and human designed world

ed and used as evidence.

- -

Connections to Nature of Science

Scientific Knowledge is Based on Empirical Evidence

- Scientists look for patterns and order when making observations about the world.

Connections to other DCIs in kindergarten: N/A

Articulation of DCIs across grade-levels:

1.LS1.A ; 2.LS2.A ; 3.LS2.C ; 3.LS4.B ; 5.LS1.C ; 5.LS2.A

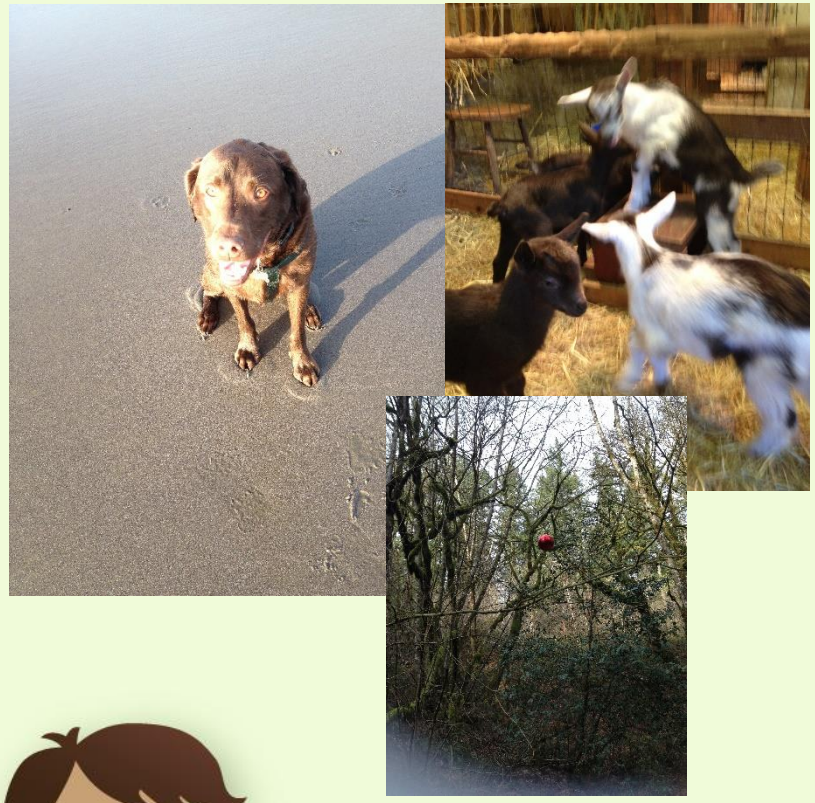
Common Core State Standards Connections:

ELA/Literacy -

You can't always jump right in with the practice listed as the PE – this is the culminating performance after a great deal of investigation, revision, argument, etc.

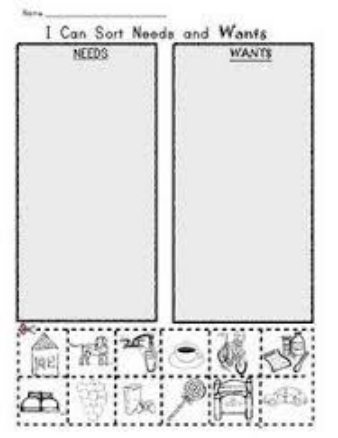
CCSS- RI.K.1
With prompting and support, ask and answer questions about key details in a text.

Engaging Phenomenon: Student Voice & Choice!



- In order to determine a pattern, you must have more than 1 piece of data to compare
- Locate the focus question in the FOSS lesson plan (page 19)
  - Goldfish & guppies
  - Land & water snails
  - Big & little worms
  - Pill bugs & sow bugs
  - Goats & dogs??
  - Plants & trees?


O
observe
W
Wonder
L
Learn

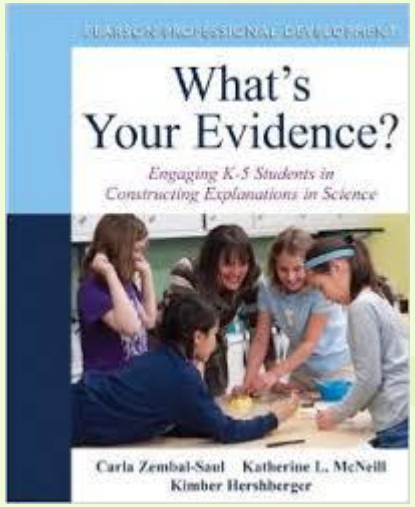


Focus Question: What do all animals need to survive?

- For each comparison in the kit, create a class content chart (T-chart) comparing needs and wants.
- At the end of each investigation, students can develop an explanation based in evidence for the question.
  - CLAIMS - EVIDENCE

Claims, Evidence, Reasoning – Constructing Explanations

- ☐ I stated a “claim”.
- ☐ I supported my “claim” with “evidence” from my science journal, talks with other scientists in my class, and from the books I read.
- ☐ I used words like (e.g., *because* and *also*) when connecting my claims with evidence.



Making Claims – Linking to Evidence through Close Reading

- What is your claim? Your claim is an answer to the question.
- Can you find evidence to back your claim?

- Here is our connection to the informational text.
- What evidence can you gather from the text that supports your claim?
- Highlight anything from the text that provides **evidence.**

Claims-Evidence-reasoning frame

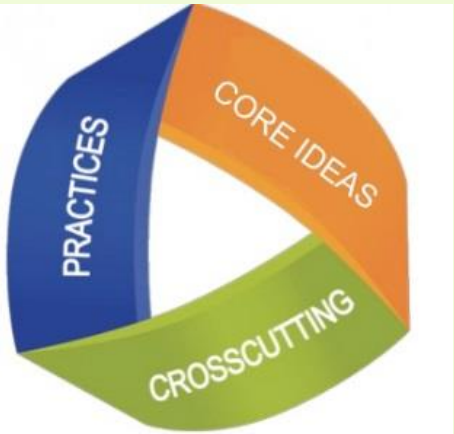
- I claim that a goldfish and (a plant, a panda, my baby sister) both need _____ to survive.
  - Use this claim as your topic sentence.
- Use one piece of evidence from your investigation and one piece from your text.
  - This is sentence 2 and 3.
- *Explain WHY this piece of evidence supports your claim- this is your reasoning.*
  - *Here is your because sentence.*

Constructing Explanations

Success Criteria:

- What would you expect your Kindergartners to be able to do?
- Read through the information about the practice in the Foundations Box
- Read through the matrix from Appendix F – what are Kindys expected to do for Constructing Explanations?

What do I do with Crosscutting Concepts?



“What Do I Do with Crosscutting Concepts”

by Dr. Cary Sneider

Use the “Focused Reading” Protocol to process the information in the article.

As you read:

1. **Decide which crosscutting concept is most appropriate for the science idea we are working on**
2. **Annotate the text with the following:**

- √ = Got it. I know or understand this
- ♥ = I want to work on this right away!
- ! = This is really important information
- ? = I’d like clarification or elaboration of this material

What do I do with Crosscutting Concepts?

Read, Walk, and Talk

1. When you finish, choose a walking partner.
2. Take a 10 minute walk through the building (or go outside!).
3. Discuss which CCC you think best works with this idea and questions you have.
4. Be prepared to share when you return:
   - A teaching move for using the CCC
   - A question

Analyzing and Interpreting Data

Push, Pull, GO!

Focus Question: How can you measure the amount of force used to push the swing?

- Collect materials and build the swing set
- Develop a data chart that you would use with your class to answer the question.

- Let’s share out in 10 minutes!

K.Forces and Interactions: Pushes and Pulls

K.Forces and Interactions: Pushes and Pulls

Students who demonstrate understanding can:

K-PS2-1. 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. [Clarification Statement: Examples of pushes or pulls could include a string attached to an object being pulled, a person pushing an object, a person stopping a rolling ball, and two objects colliding and pushing on each other.] [Assessment Boundary: Assessment is limited to different relative strengths or different directions, but not both at the same time. Assessment does not include non-contact pushes or pulls such as those produced by magnets.]

K-PS2-2. Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or a pull.* [Clarification Statement: Examples of problems requiring a solution could include having a marble or other object move a certain distance, follow a particular path, and knock down other objects. Examples of solutions could include tools such as a ramp to increase the speed of the object and a structure that would cause an object such as a marble or ball to turn.] [Assessment Boundary: Assessment does not include friction as a mechanism for change in speed.]

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

Planning and Carrying Out Investigations
Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.
- With guidance, plan and conduct an investigation in collaboration with peers. (K-PS2-1)

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. (K-PS2-2)

Connections to Nature of Science

Scientific Investigations Use a Variety of Methods
- Scientists use different ways to study the world. (K-PS2-1)

Disciplinary Core Ideas

PS2.A: Forces and Motion
- Pushes and pulls can have different strengths and directions. (K-PS2-1),(K-PS2-2)
- Pushing or pulling on an object can change the speed or direction of its motion and can start or stop it. (K-PS2-1),(K-PS2-2)

PS2.B: Types of Interactions
- When objects touch or collide, they push on one another and can change motion. (K-PS2-1)

PS3.C: Relationship Between Energy and Forces
- A bigger push or pull makes things speed up or slow down more quickly. *(secondary to K-PS2-1)*

ETS1.A: Defining Engineering Problems
- A situation that people want to change or create can be approached as a problem to be solved through engineering. Such problems may have many acceptable solutions. *(secondary to K-PS2-2)*

Crosscutting Concepts

Cause and Effect
- Simple tests can be designed to gather evidence to support or refute student ideas about causes. (K-PS2-1),(K-PS2-2)

Connections to other DCIs in kindergarten: **K.ETS1.A** (K-PS2-2); **K.ETS1.B** (K-PS2-2)

Articulation of DCIs across grade-levels: **2.ETS1.B** (K-PS2-2); **3.PS2.A** (K-PS2-1),(K-PS2-2); **3.PS2.B** (K-PS2-1); **4.PS3.A** (K-PS2-1); **4.ETS1.A** (K-PS2-2)

Common Core State Standards Connections:

ELA/Literacy –

RI.K.1	With prompting and support, ask and answer questions about key details in a text. *(K-PS2-2)*
W.K.7	Participate in shared research and writing projects (e.g., explore a number of books by a favorite author and express opinions about them). (K-PS2-1)
SL.K.3	Ask and answer questions in order to seek help, get information, or clarify something that is not understood. *(K-PS2-2)*

Mathematics –

MP.2	Reason abstractly and quantitatively. *(K-PS2-1)*
K.MD.A.1	Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object. *(K-PS2-1)*

CCSS- K.MD.A.1 Describe measurable attributes of objects, such as length or weight.

CCSS – K.CC.4.A

Building on Student Thinking

- Jigsaw the Assessment Observation sheet
  - A - vocabulary
  - B – stop motion or change direction
  - C – testing ideas about patterns of motion
  - D - gravity
  - E – discuss motion and force
  - F – other considerations

Thanks!

Science Survey:

Course Key:

Clock Hour number: