

Transitioning to New Science Standards: Targeted Support for Elementary Teachers (Day 1)



ADE State Initiated Professional Development

Presenter(s) Name(s)

Location where PD is delivered

Date PD Occurred

Pre Survey



Norms/Housekeeping

- Silence technology please
- Keep yourself comfortable
- Connect devices using



Goals

Participants will:

- explore the new *Arkansas K-12 Science Standards*.
- engage in the **science and engineering practices**.
- compare “***traditional science***” instruction to “***sense-making***” instruction.

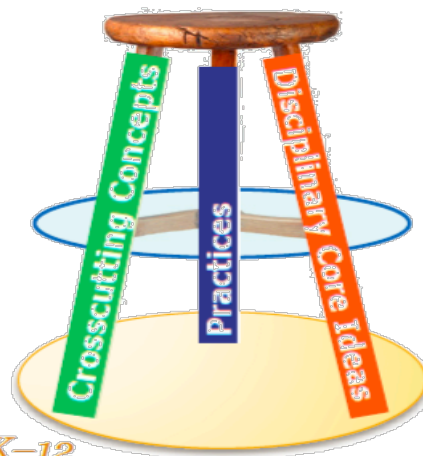


How will current instruction change to align with Arkansas K-12 Science Standards and Common Core State Standards, allowing students to deepen their understanding of science phenomenon and increase college and career readiness?



Performance
Expectations

“...what students should
know and be able to do.”



*Connections to the Nature of Science
and Engineering Applications*

*A Framework for K–12
Science Education*



*Common Core Math
and Literacy*



Identify

Science and Engineering
Practices (SEP)

Cross Cutting Concepts (CCC)

Disciplinary Core Idea (DCI)



ORANGE



4-PS3 Energy

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.]

SEP	DCI	CCC
<p>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.</p> <ul style="list-style-type: none"> Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships. (4-PS3-3) <p>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.</p> <ul style="list-style-type: none"> 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) 	<p>PS3.A: Definitions of Energy</p> <ul style="list-style-type: none"> 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) <p>PS3.B: Conservation of Energy and Energy Transfer</p> <ul style="list-style-type: none"> 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. 	<p>Energy and Matter</p> <ul style="list-style-type: none"> Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2), (4-PS3-3), (4-PS3-4) <p>-----</p> <p>Connections to Engineering, Technology, and Applications of Science Influence of Science, Engineering and Technology on Society and the Natural World</p> <ul style="list-style-type: none"> Engineers improve existing technologies or develop new ones. (4-PS3-4) <p>-----</p> <p>Connections to Nature of Science Science is a Human Endeavor</p> <ul style="list-style-type: none"> Most scientists and engineers work in teams. (4-PS3-4)



Connecting the Elements

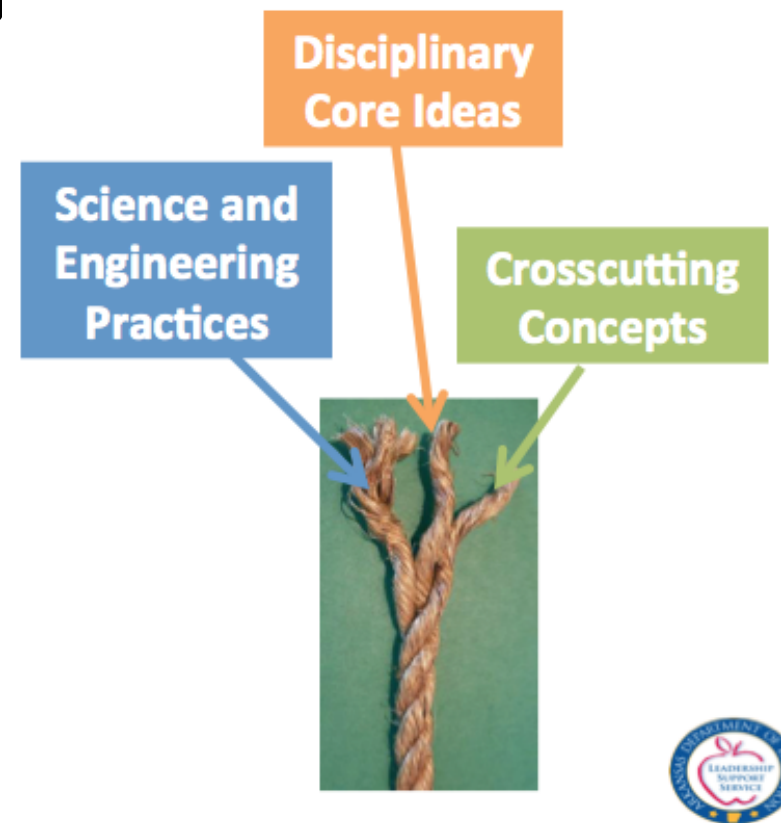
3-Dimensional Learning

4-PS3-1 Yellow

4-PS3-2 Purple

4-PS3-3 Turquoise

4-PS3-4 Pink



4-PS3 Energy

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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.]

SEP	DCI	CCC
<p>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.</p> <ul style="list-style-type: none"> Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships. (4-PS3-3) <p>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.</p> <ul style="list-style-type: none"> 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) 	<p>PS3.A: Definitions of Energy</p> <ul style="list-style-type: none"> 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) <p>PS3.B: Conservation of Energy and Energy Transfer</p> <ul style="list-style-type: none"> 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) 	<p>Energy and Matter</p> <ul style="list-style-type: none"> Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2), (4-PS3-3), (4-PS3-4) <p>Connections to Engineering, Technology, and Applications of Science Influence of Science, Engineering and Technology on Society and the Natural World</p> <ul style="list-style-type: none"> Engineers improve existing technologies or develop new ones. (4-PS3-4) <p>Connections to Nature of Science Science is a Human Endeavor</p> <ul style="list-style-type: none"> Most scientists and engineers work in teams. (4-PS3-4)



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SEP

Asking Questions and Defining Problems

Asking questions and defining problems is grades 3-5 builds on grades 4-5 experiences and progresses to specifying qualitative relationships.

- **Asking questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships, identifying patterns and carrying out investigations to answer questions or test solutions to problems is 3-5 builds on 4-5 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 to design a solution to a problem.**

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 3-5 builds on 4-5 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena used in designing multiple solutions to design problems.

- **Use evidence (e.g., measurements, observations, patterns) to construct an explanation. (4-PS3-1)**
- **Apply scientific ideas to solve design problems. (4-PS3-4)**

DCI

PS3.A: Definitions of Energy

- **The faster a given object is moving, the more energy it possesses. (4-PS3-3)**

- **Energy can be moved from place to place by moving objects or through sound, light, or electric currents. (4-PS3-2)**

PS3.B: Conservation of Energy and Energy Transfer

- **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-PS3-3)**

- **Energy can also be transferred from place to place by electric currents.**

- **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 transferring the energy of motion into electrical energy. (4-PS3-2)**

PS3.C: Relationship Between Energy and Forces

- **When objects collide, the contact forces transfer energy so as to change the objects' motions. (4-PS3-3)**

PS3.D: Energy in Chemical Processes and Everyday Life

- **The expression "produce energy" typically refers to the conversion of stored energy into a desired form for practical use. (4-PS3-4)**

ETS1.A: Defining Engineering Problems

- **Problem solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined 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 uses the constraints to do so. (4-PS3-4)**

CCC

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)**

Connections to Engineering, Technology, and Applications of Science, Engineering and Technology on Society and the Natural World

- **Engaging in given existing technologies or developing new ones. (4-PS3-4)**

Connections to Nature of Science Science is a Human Endeavor

- **Most scientists and engineers work in teams. (4-PS3-1)**
- **Scientists share evidence that they use. (4-PS3-1)**

Connections to other DCIs in fourth grade:

N/A

Integration of DCIs across grade levels: **4-PS3-1** (4-PS3-1), **4-PS3-2** (4-PS3-2), **4-PS3-3** (4-PS3-3), **4-PS3-4** (4-PS3-4), **4-PS3-5** (4-PS3-5), **4-PS3-6** (4-PS3-6), **4-PS3-7** (4-PS3-7), **4-PS3-8** (4-PS3-8), **4-PS3-9** (4-PS3-9), **4-PS3-10** (4-PS3-10), **4-PS3-11** (4-PS3-11), **4-PS3-12** (4-PS3-12), **4-PS3-13** (4-PS3-13), **4-PS3-14** (4-PS3-14), **4-PS3-15** (4-PS3-15), **4-PS3-16** (4-PS3-16), **4-PS3-17** (4-PS3-17), **4-PS3-18** (4-PS3-18), **4-PS3-19** (4-PS3-19), **4-PS3-20** (4-PS3-20), **4-PS3-21** (4-PS3-21), **4-PS3-22** (4-PS3-22), **4-PS3-23** (4-PS3-23), **4-PS3-24** (4-PS3-24), **4-PS3-25** (4-PS3-25), **4-PS3-26** (4-PS3-26), **4-PS3-27** (4-PS3-27), **4-PS3-28** (4-PS3-28), **4-PS3-29** (4-PS3-29), **4-PS3-30** (4-PS3-30), **4-PS3-31** (4-PS3-31), **4-PS3-32** (4-PS3-32), **4-PS3-33** (4-PS3-33), **4-PS3-34** (4-PS3-34), **4-PS3-35** (4-PS3-35), **4-PS3-36** (4-PS3-36), **4-PS3-37** (4-PS3-37), **4-PS3-38** (4-PS3-38), **4-PS3-39** (4-PS3-39), 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How does the traditional (information provider) science class need to change in order to become a (sense-making) class?



Tale of Two “GOOD” Classrooms

While you read, keep in mind these three questions:

- What are the students doing?
- What are the students learning?
- How is science portrayed to students in this vignette? (i.e. science is ...).

Add Padlet link



Share and Group Results

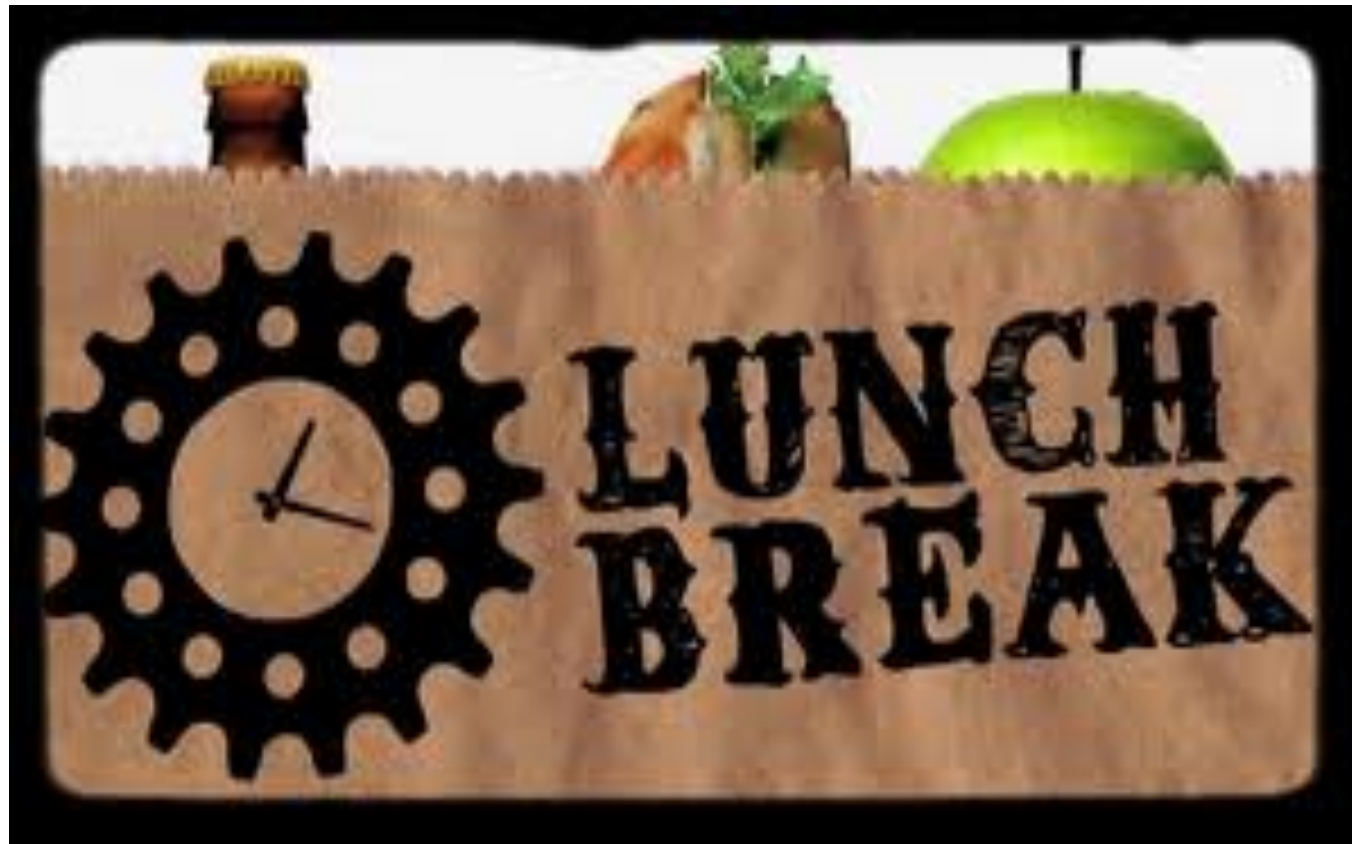
- Discuss with table group.
- Divide information into two categories:
 - Information Frame
 - Sense-Making Frame



Recognizing the Practices in Instruction

- Re-read Vignette 2
 - Keep the Practices in mind, circle and label segments of Vignette 2 where the Practices play out.
- Once you have completed your analysis have a table dialogue to share your thinking.





KLEWS CHART

K - What do we think we **know**? (beginning ideas, predictions)

L - What are we **learning**? (claims)

E - What is our **evidence**? (observations from investigation, texts)

W - What do we **wonder** about the phenomena? (testable and researchable questions)

S - What **science** ideas make our explanation stronger? (scientific principles and vocabulary)

<https://www.youtube.com/watch?v=W90hV9qiWyY>



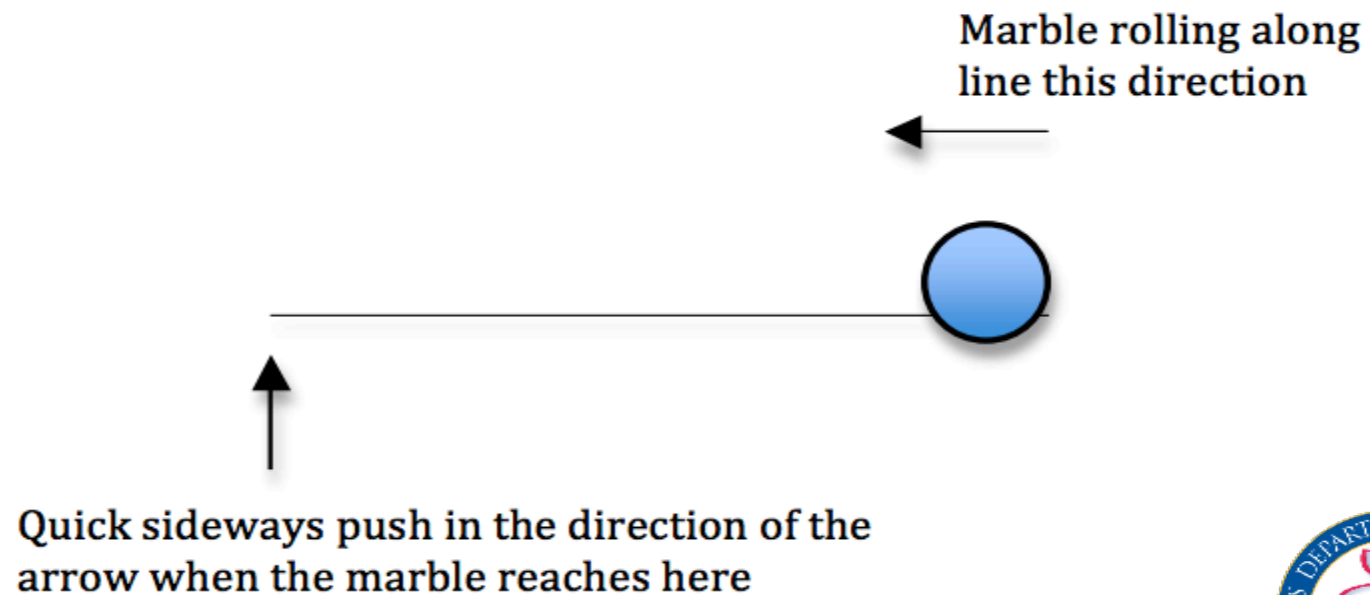
Essential Question

How can unbalanced forces produce a change in an object's motion that can be predicted and described?



Predict

What path does the marble take after the quick push?



Plan & Carry Out Investigation

How can your prediction be tested?

What procedure must be followed so others can test your prediction?



Use Models to Predict & Develop Evidence

How can quick pushes from different directions change the motion of a rolling object?





Textual Evidence

Individually read the selection.

Annotate as you read using the following symbols:

- ✓ for things you already knew
- ! for things that are new to you
- ? For things you have questions about

How does information from the article help revise your model and answer the “Essential” question – “How can unbalanced forces produce a change in an object’s motion that can be predicted and described?”



May the Force Move You

- Individually create a “crazy path” in which you predict the points of force and direction needed to travel the path.
- Compare models with table group.
- In groups, create a crazy path poster.
- Be prepared to share poster.



Golden Lines

How should student thinking develop as they construct and revise models?

What does constructing and revising models look like in a science classroom? pg. 23

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- ✓ How should *Developing and Using Models* look in your grade level?
- ✓ What type of student evidence will indicate the use of this practice?
- ✓ How should their thinking develop as they utilize this practice?



Exit Slip

Gots and Needs

