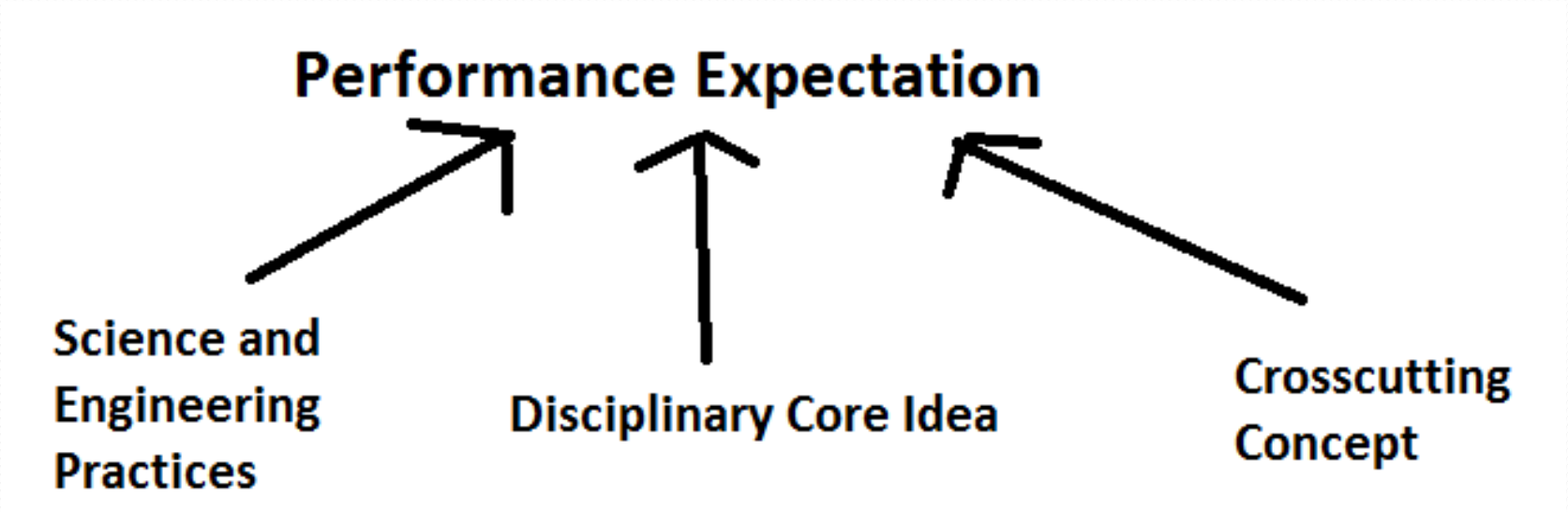
The 3 Dimensions merge in the Performance Expectation statement



Three-Dimensional Instruction

Students

- Build models
- Design investigations
- Share ideas
- Develop explanations
- Argue Using Evidence

- Use 21st Century skills-Problem solve, Think Critically, Communicate, Collaborate, and Self Manage.

Source: Joe Krajcik The Science Teacher November 2015

Let’s look at 3 vignette lessons.

Each lesson may be used to address standards-one from each grade.

- 6-MS-PS2-1 *Applying Newton’s Third Law*
- 7-MS-ESS2-4 *Cycling of Water through the Earth’s systems*
- 8-MS-LS1-4 *Animal behaviors and specialized plant structures that affect probability of survival and successful reproduction*

Engaging students in Activities

- Integrating the 3 dimensions during before, during and after an activity
- Phenomena, Inquiry, Doing, Questioning
- Assessment-formative & summative

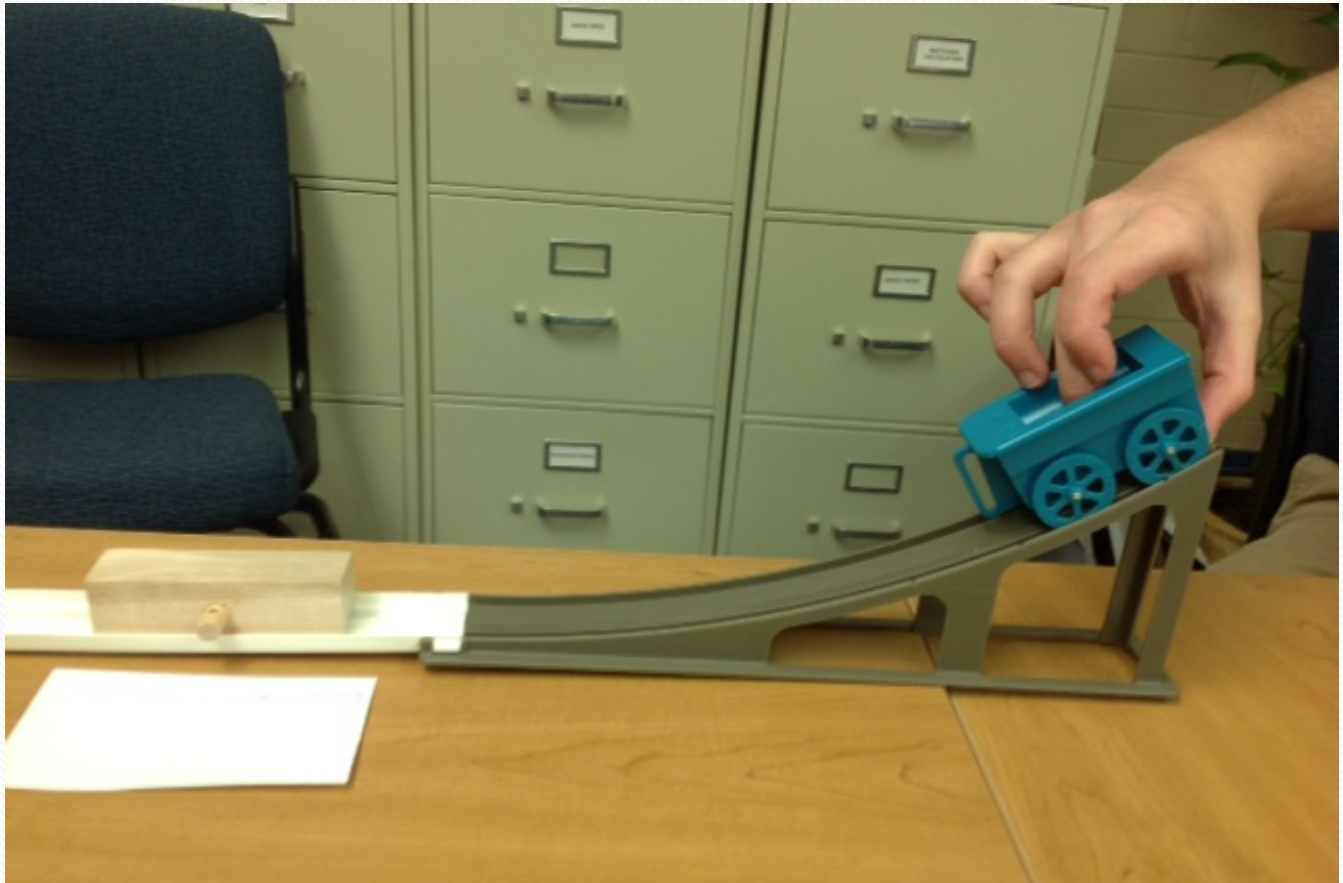
Phenomena

- https://www.youtube.com/watch?v=SpZ0pjju_uY

What questions do you have about this Phenomena?

Exploring with a cart and ramp

- Set up the ramp as shown with wood block 5 cm gap from base of track



Objective: Collect Data when releasing cart from locales on ramp

- Release the cart-What happens to wooden block
- Collect meaningful data about cart and block
- Why does the block move?
- What have you discovered?

Examining and Correlating the Standard to the Activity

Louisiana STUDENT STANDARDS SCIENCE

6

6-MS-PS2-1

MOTION AND STABILITY: FORCES AND INTERACTIONS

Performance Expectation	Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.
Clarification Statement	Examples of practical problems could include reducing the effects of impact of two objects such as two cars hitting each other, an object hitting a stationary object, or a meteor hitting a spacecraft.

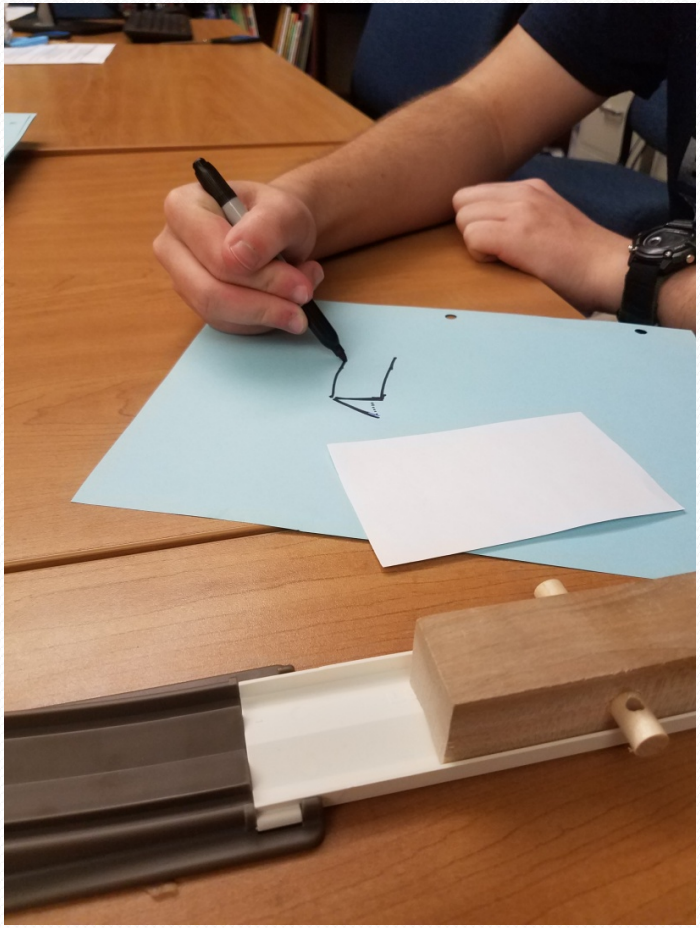
Science & Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
1. Asking questions and defining problems 2. Developing and using models 3. Planning and carrying out investigations 4. Analyzing and interpreting data 5. Using mathematics and computational thinking **6. Constructing explanations and designing solutions:** Constructing explanations (science) and designing solutions (engineering) in 6–8 builds on K–5 experiences and progresses to include designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. • Apply scientific ideas or principles to design, construct, and/or test a design of an object, tool, process or system. 7. Engaging in argument from evidence 8. Obtaining, evaluating, and communicating information	**FORCES AND MOTION** For any pair of interacting objects, the force exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first, but in the opposite direction (Newton's third law). (MS.PS2A.a) **DEVELOPING POSSIBLE SOLUTIONS** A solution needs to be tested,to prove the validity of the design and then modified on the basis of the test results in order to improve it. There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. Models of all kinds are important for testing solutions (MS.ETS1B.a)	**SYSTEMS AND SYSTEM MODELS** Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy, matter, and information flows within systems.

How have we addressed the standard? (6-MS-PS2-1)

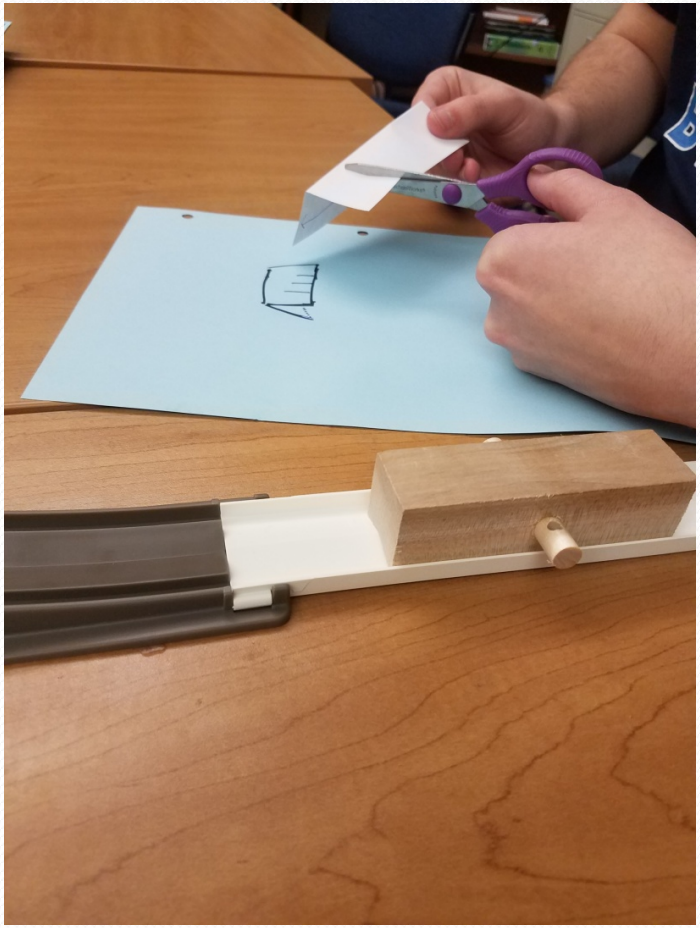
- Disciplinary Core Ideas?
- Science and Engineering Practices?
- Cross Cutting?

- Performance Expectation-which parts(verbs/nouns)?
  - Clarification statement=how addressed?

Create a Collision Barrier plan



Build a Collision Barrier



Test your Collision Barrier

- A collision barrier should fit within the 5 cm gap between the block and the track base
- The collision barrier should fit between the block and the base of the track, and not exist on the track
- The collision barrier should slow the impact of the cart on the block …but should not cause the cart to derail from the track.

Results and Improving Results

- You tested your solution – creating a Collision Barrier.
- How well did your solution meet the criteria of slowing down the collision, and keeping cart on track?
- Discuss with another team their results…
- Revise your solution to improve the results.

Assessment of Standard

- How would we start in creating a summative Assessment?
- What was the Phenomena we were investigating?
- What were questions we had?
- How does the activity –both parts address the Disciplinary core ideas?

Analyze an Assessment

- Examine the brief scenario/phenomena event
- Read questions in assessment and link to Standard 6-MS-PS 2-1

6-MS-PS2-1 Assessment-Egg Collisions

Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.

Children tap eggs, trying to crack each others' egg first. Photo Sheri Lane Dunbar.

In many parts of south Louisiana, there is a tradition during the Easter holidays where children and adults alike have a contest often referred to as pacquing eggs. In the contest, two people each select a boiled egg. One person holds his/her egg in the palm of hand while a second person positions their egg directly above the other egg. The person with the egg above, on cue, when agreed taps his egg on the egg below.

Usually the eggs are positioned so that the more narrow ends of the egg face each other. When boiled, this narrow end of the egg tends to fill up with egg yolk and is more "solid" than the more rounded part of the egg (on opposite end).

1. Which statement best describes the event of egg pacquing(knocking)?
   a. an object at rest tends to stay at rest, and an object in motion tends to

Phenomena

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

Kisatchie National Forest

What questions do you have about this phenomena?

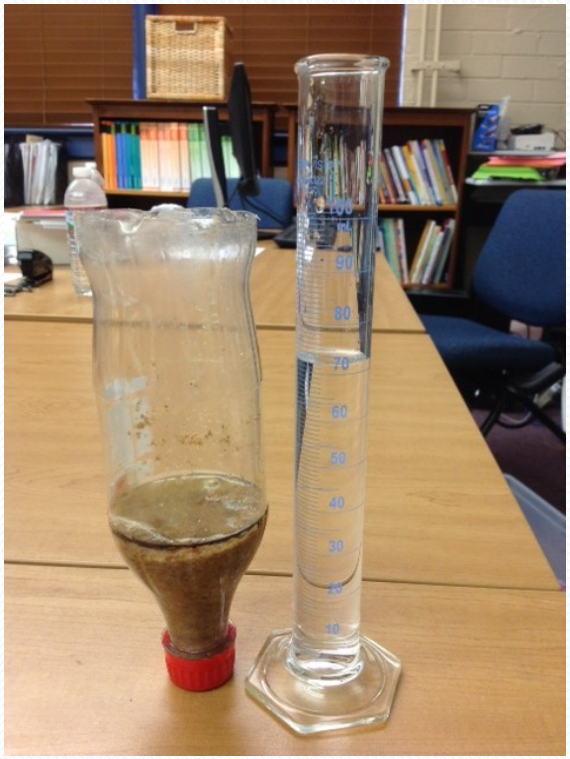
Exploring Porosity and Permeability

- Determine the porosity of your s

- Prepare your
- graduated cylinder
- with 100 ml

Porosity of Sand

- Pour water into the water bottle until it pools. Calculate how much water(ml) is in sand container.



Permeability of Sand

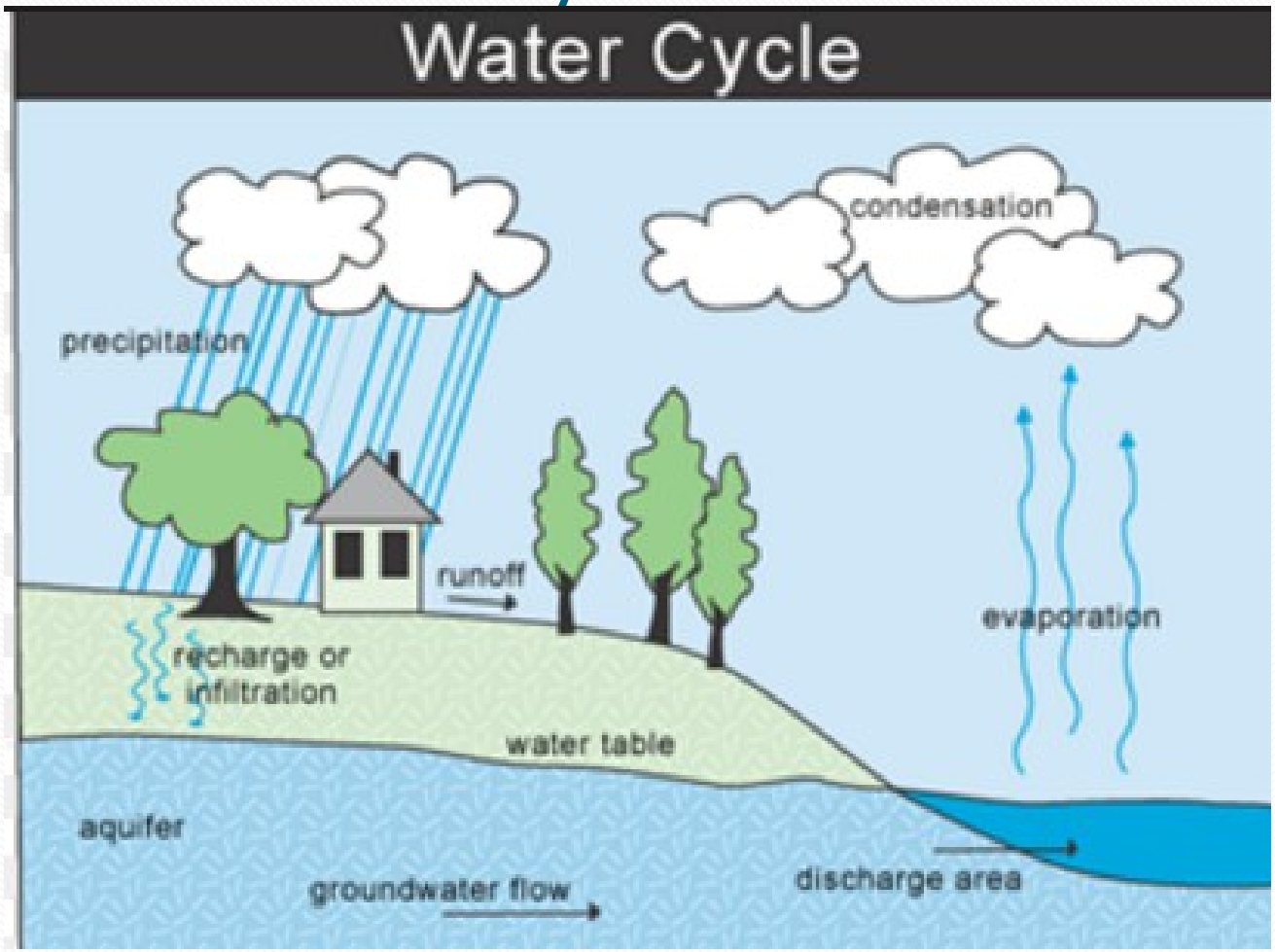
- Using a stop watch, time the flow of water through the sand container.
- Pour remaining water from grad. Cylinder into sand container.
- Add another 100 ml of water to the grad cylinder.
- Open carefully the lid of the sand container, as the water begins flowing, add 100 ml of water

How long does it take for 200 ml to flow through sand?

Repeat Porosity and Permeability tests with Gravel container

- From your experience with the activity…What is porosity?
- How does the porosity of gravel differ from that of sand?
- What is permeability?
- How does the permeability of Sand differ from Gravel?

How is Porosity / Permeability an Integral Part of the Water Cycle?



Examining and Correlating the Standard to the Activity

Louisiana STUDENT STANDARDS SCIENCE

7

7-MS-ESS2-4

EARTH'S SYSTEMS

Performance Expectation	Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.
Clarification Statement	Emphasis is on the ways water changes its state and location as it moves through the multiple pathways of the hydrologic cycle. Examples of models can be conceptual or physical.

Science & Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
1. Asking questions and defining problems 2. **Developing and using models:** Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems. • Develop a model to describe unobservable mechanisms. 3. Planning and carrying out investigations 4. Analyzing and interpreting data 5. Using mathematics and computational thinking 6. Constructing explanations and designing solutions 7. Engaging in argument from evidence 8. Obtaining, evaluating, and communicating information	**THE ROLES OF WATER IN EARTH'S SURFACE PROCESSES:** Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land. (MS.ESS2C.a) Global movements of water and its changes in form are propelled by sunlight and gravity. (MS.ESS2C.c) **LOUISIANA'S NATURAL RESOURCES** Replenishable resources such as groundwater and oxygen are purified by the movement through Earth's cycles. (MS.EVS1A.c)	**ENERGY AND MATTER** Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter.

How can we address this DCI by amending the existing activity?

Louisiana STUDENT STANDARDS SCIENCE

7

7-MS-ESS2-4

EARTH'S SYSTEMS

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1. Asking questions and defining problems 2. **Developing and using models:** Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems. • Develop a model to describe unobservable mechanisms. 3. Planning and carrying out investigations 4. Analyzing and interpreting data 5. Using mathematics and computational thinking 6. Constructing explanations and designing solutions 7. Engaging in argument from evidence 8. Obtaining, evaluating, and communicating information	**THE ROLES OF WATER IN EARTH'S SURFACE PROCESSES:** Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land. (MS.ESS2C.a) Global movements of water and its changes in form are propelled by sunlight and gravity. (MS.ESS2C.c) **LOUISIANA'S NATURAL RESOURCES** Replenishable resources such as groundwater and oxygen are purified by the movement through Earth's cycles. (MS.EVS1A.c)	**ENERGY AND MATTER** Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter.

Analyze an Assessment

- Examine the brief scenario/phenomena event
- Read questions in assessment and link to Standard 7-MS-ESS2-4

7-MS-ESS2-4 Is groundwater clean water? Assessment

Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.

A group of students were planting a tree on their school campus during Earth Day. As they were digging a hole to place the tree into, they noticed water slowly pooling into the hole from the surrounding soil. They asked their teacher where the water was coming from. Their teacher, Mrs. Caesar replied "its groundwater, and probably was a few inches below the top of the ground. Remember it rained a few days ago."

The students finished planting the tree, but asked their teacher if they could collect some of the groundwater for further study. She quickly agreed and told the students that soil are great water purifiers and represent the largest natural filter on earth! They noticed upon returning the classroom that the water they collected was relatively "clear" of particles.

Mrs. Caesar asked the students to set up water filtration system using natural materials from their playground to see how clean they could get "dirty water".

Phenomena

- https://www.youtube.com/results?search_query=Time+lapse+Dandelion+from+flowers+to+seeds+HD

What questions do you have about this phenomena?

Exploring the diverse world of Seeds

- Study the packet of seeds for variations in structure

Seeds and Animals

- Seeds are transported by Animals(attach to fur, wind, water, and or self mechanism.
- Look at the seeds in your packet – can you infer from their structure how they disperse.
- Make a chart to record your thoughts
- What are some characteristics of each seed that make you think it is transported a certain way?

Examining and Correlating the Standard to the Activity

Louisiana STUDENT STANDARDS SCIENCE

8

8-MS-LS1-4

FROM MOLECULES TO ORGANISMS: STRUCTURES AND PROCESSES

Performance Expectation	Construct and use argument(s) based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of survival and successful reproduction of animals and plants respectively.
Clarification Statement	Examples of behaviors that affect the probability of animal reproduction could include nest building to protect young from cold, herding of animals to protect young from predators, or vocalization of animals and colorful plumage to attract mates for breeding. Examples of animal behaviors that affect the probability of plant reproduction could include transferring pollen or seeds or creating conditions for seed germination and growth. Examples of plant structures could include bright flowers attracting butterflies that transfer pollen, flower nectar and odors that attract insects that transfer pollen, or hard shells on nuts that squirrels bury.

Science & Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
1. Asking questions and defining problems 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 and designing solutions **7. Engaging in argument from evidence:** Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s). • Construct, use, and/or present an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. 8. Obtaining, evaluating, and communicating information	**GROWTH AND DEVELOPMENT OF ORGANISMS** Animals engage in characteristic behaviors that increase the odds of reproduction. (MS.LS1B.c) Plants (flowering and non-flowering) reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction. (MS.LS1B.d) Group behavior has evolved because membership can increase the chances of survival for individuals and their genetic relatives. (MS.LS2D.a)	**CAUSE AND EFFECT** Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability.

Analyze an Assessment

- Examine the brief scenario/phenomena event
- Read questions in assessment and link to Standard 8-MS-LS1-4

8-MS-LS1-4 Assessment-Dog Hair Traveling

Construct and use argument(s) based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of survival and successful reproduction of animals and plants respectively.

Brian has two dogs, Spot and Humphrey. In the spring time, Brian's back yard sprouts several types of clover. The seeds of the clover are found in abundance in the form of clover burrs.

Brian noticed that one of his dogs, Humphrey, picks up clover burrs on his hair while the other dog, Spot, rarely has any burrs on his hair.

Reviewing Three-Dimensional Instruction

Students

- Build models
- Design investigations
- Share ideas
- Develop explanations
- Argue Using Evidence

- Use 21st Century skills-Problem solve, Think Critically, Communicate, Collaborate, and Self Manage.

Source: Joe Krajcik The Science Teacher November 2015

Sources of Lesson Ideas

- NMSI-Why did the Seed Cross the Road?
- NMSI-Porosity and Permeability
- Lab Aids-Issue and Physical Science #76
- Dr. Dirt K-12 Teaching Resources http://www.doctordirt.org/teachingresources/soilfilter

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