



Implementing the NM STEM Ready! Science Standards

Planning Instruction Using Phenomena

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Goals

- Define phenomena & its role in the standards
- Identify types of phenomena
- Determine criteria for selecting phenomena
- Resources

NM STEM Ready! Science Standards

$$\begin{array}{c} \text{NGSS} \\ + \\ \text{New Mexico 6} \\ \text{Specific Standards} \end{array} = \begin{array}{c} \text{New Mexico} \\ \text{STEM Ready!} \\ \text{science standards} \end{array}$$

Together, the NGSS in their entirety,
plus the New Mexico 6
specific standards comprise the
NM STEM Ready! science standards.

What is a NM STEM Ready!

science standard?

Students who demonstrate understanding can:

- 3-PS2-1. Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.** [Clarification Statement: Examples could include an unbalanced force on one side of a ball can make it start moving; and, balanced forces pushing on a box from both sides will not produce any motion at all.] [Assessment Boundary: Assessment is limited to one variable at a time: number, size, or direction of forces. Assessment does not include quantitative force size, only qualitative and relative. Assessment is limited to gravity being addressed as a force that pulls objects down.]

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

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<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"> Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. <p>-----</p> <p>Connections to Nature of Science</p> <p>Scientific Investigations Use a Variety of Methods</p> <ul style="list-style-type: none"> Science investigations use a variety of methods, tools, and techniques. 	<p>PS2.A: Forces and Motion</p> <ul style="list-style-type: none"> Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion. (Boundary: Qualitative and conceptual, but not quantitative addition of forces are used at this level.) <p>PS2.B: Types of Interactions</p> <ul style="list-style-type: none"> Objects in contact exert forces on each other. 	<p>Cause and Effect</p> <ul style="list-style-type: none"> Cause and effect relationships are routinely identified.
<p>Connections to other DCIs in third grade: N/A</p> <p>Articulation of DCIs across grade-levels: K.PS2.A ; K.PS2.B ; K.PS3.C ; 5.PS2.B ; MS.PS2.A ; MS.ESS1.B ; MS.ESS2.C</p> <p>Common Core State Standards Connections:</p> <p>ELA/Literacy - RI.3.1 Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers. (3-PS2-1) W.3.7 Conduct short research projects that build knowledge about a topic. (3-PS2-1) W.3.8 Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories. (3-PS2-1)</p> <p>Mathematics - MP.2 Reason abstractly and quantitatively. (3-PS2-1) MP.5 Use appropriate tools strategically. (3-PS2-1) 3.MD.A.2 Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l). Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units, e.g., by using drawings (such as a beaker with a measurement scale) to represent the problem. (3-PS2-1)</p>		

What is a NM STEM Ready!

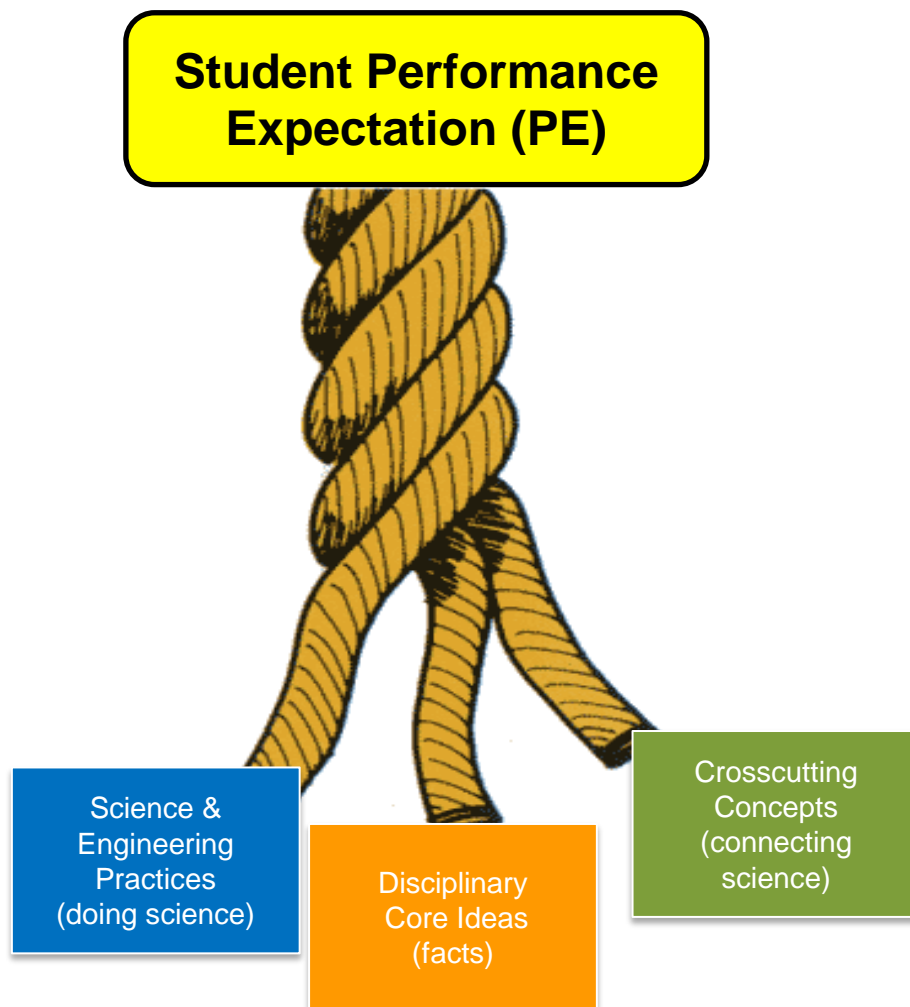
Science standard?

<p>who demonstrate understanding can:</p> <p>PS2-1. Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object. [Clarification Statement: Examples could include an unbalanced force on one side of a ball can make it start moving; and, balanced forces pushing on a box from both sides will not produce any motion at all.] [Assessment Boundary: Assessment is limited to one variable at a time: number, size, or direction of forces. Assessment does not include quantitative force size, only qualitative and relative. Assessment is limited to gravity being addressed as a force that pulls objects down.]</p>		
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<p>Common Core State Standards Connections:</p>		
<p>ELA/Literacy -</p>		
RI.3.1	Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers. (3-PS2-1)	
W.3.7	Conduct short research projects that build knowledge about a topic. (3-PS2-1)	
W.3.8	Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories. (3-PS2-1)	
<p>Mathematics -</p>		
2.2	Reason abstractly and quantitatively. (3-PS2-1)	
	Use appropriate tools strategically. (3-PS2-1)	
	Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l). Add, subtract, multiply to solve one-step word problems involving masses or volumes that are given in the same units, e.g., by using drawings (such as a beaker with measurement scale) to represent the problem. (3-PS2-1)	

Reading a Standard

- <http://www.nextgenscience.org/pe/ms-ps1-3-matter-and-its-interactions>

3-Dimensional Learning



Adapted from NSTA



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Christopher N. Ruszkowski
Secretary of Education

Performance Expectations

ARE

- Guidance for what students should be able to do and understand.
- Specifications for assessments.

ARE NOT

- Learning goals for students
- Instructional strategies for students
- Tests for students

Adapted from Bybee (2013) and Krajcik (2014)

Strategies for Planning Instruction

- Phenomena
- Curriculum Adaptation
- Backwards Design
- Bundling Standards
- Storylines

Which of these planning strategies are you currently using?

Strategies for Planning Instruction

- **Phenomena**
- Curriculum Adaptation
- Backwards Design
- Bundling Standards
- Storylines

Goals

- Define phenomena & its role in the standards
- Identify types of phenomena
- Determine criteria for selecting phenomena
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Phenomena

Defining Phenomena

- “Occurrences in the natural and human-made world that can be observed and cause one to wonder and ask questions....requires students to use the science and engineering practices (SEPs), crosscutting concepts (CCCs), and disciplinary core ideas (DCIs) in concert to explore, investigate and explain how and why phenomena occur” (Cerwin et al, 2018, p. 9).

Phenomena

Defining Phenomena (continued)

Phenomena:

- Should elicit curiosity and engagement from students
- Has relevance to students' environment
- Does not have to be phenomenal; can be a simple event

Phenomena



Link:

https://www.youtube.com/watch?v=Zz95_VvTxZM

Phenomena



Phenomena Brian Reiser video link:

<https://www.youtube.com/watch?v=Jyiv1Lc0dng>

Teaching Channel video on Phenomena:

<https://www.teachingchannel.org/video/using-phenomena-achieve>

Phenomena

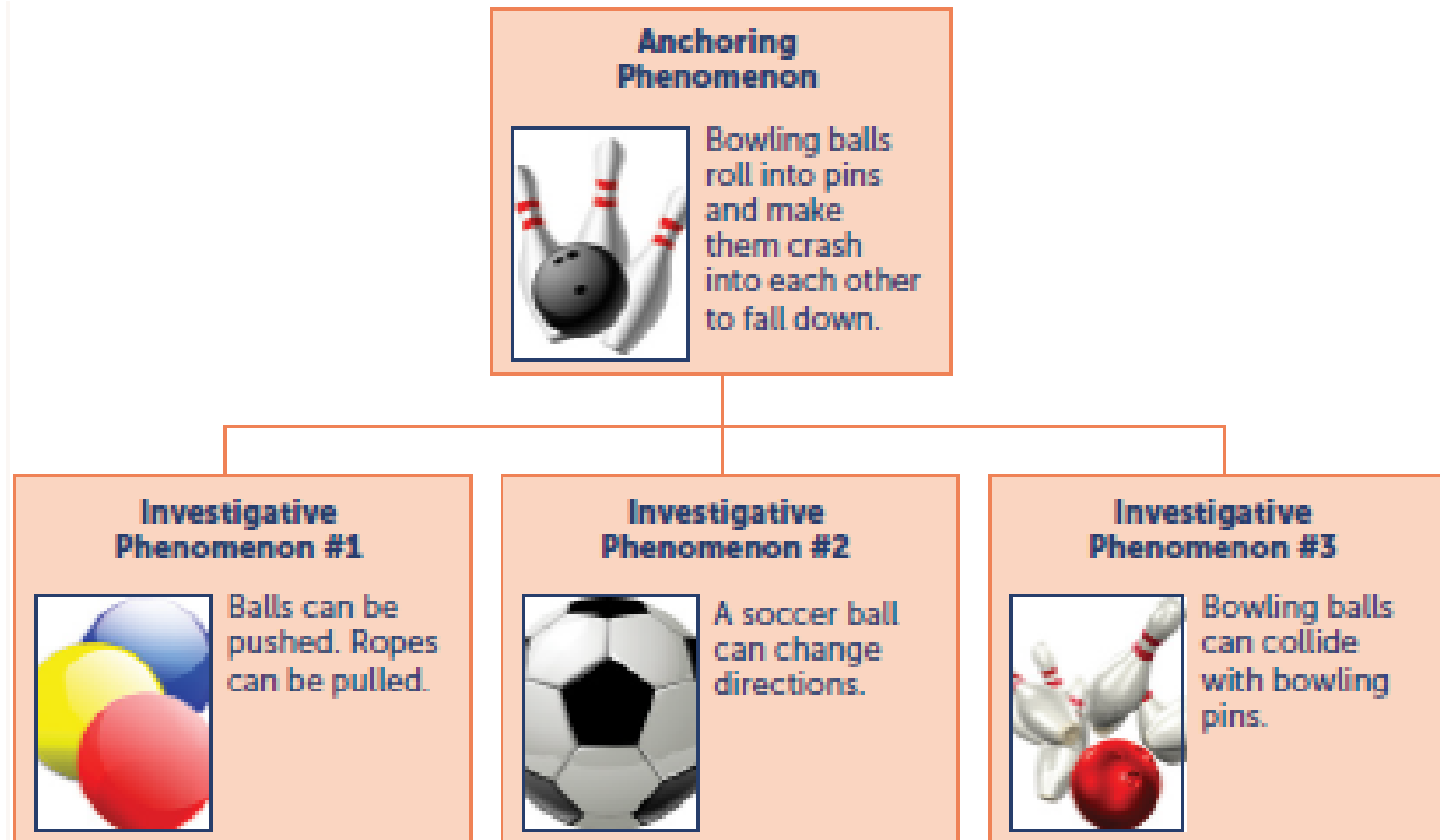
Importance

- Anchoring learning in explaining phenomena supports student in building science and engineering knowledge.
- Students engage in the 3-dimensions to investigate and explain how or why phenomena occur.

(Adapted from Institute for Science + Math Education, n.d.)

Phenomena

Types of Phenomena



K-12 Alliance @WestEd 2018

Phenomena Based *Criteria*

Is the phenomena:

- Observable or able to be investigated through firsthand experiences?
- Going to build understanding towards the grade level performance expectation(s)?
- Grade-level appropriate?
- Relevant to the students' local environment?
- Interesting and important?
- Justifiable in terms of financial cost and instructional time?

(Adapted from Brown et al., n.d.)

Phenomena



What concepts would students need to understand to fully explain this phenomena?

Resources

- [NM STEM Ready! Science Resources page](#)
 - Curriculum Development
 - Phenomena
 - Implementation
- [NGSS In Practice-Tools and Processes](#)
(Appendices A-E)
- STEM Teaching Tools: [28](#), [42](#)
- Achieve: [Using Phenomena in NGSS](#)

Upcoming Professional Learning

- NM STEM CONNECT [newsletter](#)
 - [Newsletter Sign Up](#)
- [Professional Learning Opportunities](#)

Contact Information

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