What does learning currently look like in science classrooms?
Looking at the 5 Innovations in a Science Classroom

April 26, 2018

Patricia Carden, Math Specialist
Shafiq Chaudhary, Math & Science Specialist
Goals

➢ To identify the possibilities of the 5 innovations for classroom instruction

➢ To consider what learning looks like in a NM STEM Ready! science classroom
NM STEM Ready! Science Standards

NGSS  
+  
New Mexico 6  
Specific Standards  

=  
NM STEM Ready! science standards

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:

<table>
<thead>
<tr>
<th>Science and Engineering Practices</th>
<th>Disciplinary Core Ideas</th>
<th>Crosscutting Concepts</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
<td>PS2.A: Forces and Motion - 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.)</td>
<td>Cause and Effect - Cause and effect relationships are routinely identified.</td>
</tr>
<tr>
<td></td>
<td>PS2.B: Types of Interactions - Objects in contact exert forces on each other.</td>
<td></td>
</tr>
</tbody>
</table>

Connections to Nature of Science

Scientific Investigations Use a Variety of Methods

- Science investigations use a variety of methods, tools, and techniques.

Connections to other DCIs in third grade: N/A

Articulation of DCIs across grade levels:

Common Core State Standards Connections:
- 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)
  - RI.3.7 Conduct short research projects that build knowledge about a topic. (3-PS2-1)
  - RI.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)

- 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)
What is a NM STEM Ready! science standard?
What makes the NM STEM Ready! science standards new and different?

Years of NGSS implementation across the country have refined our collective understanding of what is unique about the NGSS. These differences represent the **5 innovations** in science teaching and learning.
Five Innovations

Build on the shifts described in the NGSS Appendix A: Conceptual Shifts, using lessons learned by educators and researchers
Five Innovations in Classroom Instruction

1. Explaining phenomena and designing solutions to problems
2. Three-dimensional learning
3. Building K-12 learning progressions
4. Connecting the NGSS to ELA/language arts and mathematics
5. All standards, all students (Equity)
Innovation 1:
Explaining phenomena and designing solutions to problems

<table>
<thead>
<tr>
<th>More of</th>
<th>Less of</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students learning aspects of how to design solutions while engaged in</td>
<td>Students are following step-by-step instructions to a “designed solution”.</td>
</tr>
<tr>
<td>the design process.</td>
<td></td>
</tr>
<tr>
<td>Using student sense-making and solution-designing as a context for</td>
<td>Leading students to the “right answer”.</td>
</tr>
<tr>
<td>student learning.</td>
<td></td>
</tr>
</tbody>
</table>
Innovation 2:  
*Three-dimensional learning*

<table>
<thead>
<tr>
<th>More of</th>
<th>Less of</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students actively engaged in scientific practices to develop an understanding of each of the three dimensions.</td>
<td>A separate lesson or unit on science process/methods followed later by a lesson or unit focused on science knowledge.</td>
</tr>
<tr>
<td>Facts and terminology are learned as needed while developing explanations and designing solutions supported by evidence-based arguments and reasoning.</td>
<td>Rote memorization of facts and terminology; providing discrete facts and concepts in science disciplines with limited application of practice.</td>
</tr>
<tr>
<td>Science vocabulary and definitions are introduced before students develop conceptual understanding.</td>
<td></td>
</tr>
</tbody>
</table>

Christopher N. Ruszkowski  
Secretary of Education
Reflection

- How will these shifts strengthen student learning in your classroom?
Innovation 3:
*Building K-12 learning progressions*

<table>
<thead>
<tr>
<th>More of</th>
<th>Less of</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identifying students’ prior knowledge, connecting that knowledge to new</td>
<td>Providing repetitive, discrete knowledge that students memorize at each</td>
</tr>
<tr>
<td>knowledge, and building on student’s multiple entry points.</td>
<td>grade level that is disconnected from prior learning.</td>
</tr>
</tbody>
</table>
## Innovation 4: Connection to Common Core ELA and Mathematics

<table>
<thead>
<tr>
<th>More of</th>
<th>Less of</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engaging all students’ science learning experiences with explicit and intentional connections to mathematics and language arts that is meaningful, grade-appropriate and will build deep conceptual understanding in all three subject areas.</td>
<td>Science learning in isolation from related learning in English language arts and mathematics.</td>
</tr>
</tbody>
</table>
Innovation 5:  
*All standards, all students*

<table>
<thead>
<tr>
<th>More of</th>
<th>Less of</th>
</tr>
</thead>
<tbody>
<tr>
<td>The NM STEM Ready! science standards highlight important learning for all students in all grades K-12.</td>
<td>Science, especially advanced topics, is only for those interested in STEM careers. Science opportunities are inconsistent for all K-12 students.</td>
</tr>
</tbody>
</table>
Reflection

How will these shifts positively impact your instructional planning?
What does a NM STEM Ready! science classroom look like?

- https://www.nextgenscience.org/resources/video-first-steps-towards-transitioning-ngss
Resources

• Math and Science Bureau webpage
• Bozeman Science (YouTube videos)
• STEM Teaching Tools
• Teacher Channel Videos
• NGSS videos
Upcoming Professional Learning

• **STEM Symposium (June 1, 2018)**

• **Making Sense of Science (June 11-22, 2018)**
Contact Information

Math and Science Bureau

Yanira Vazquez, Director
505–827–6555
yanira.vazquez@state.nm.us

Marcia Barton, STEM Specialist
505–827–6918
marcia.barton@state.nm.us

Patricia Carden, Math Specialist
505–827–7803
patricia.carden@state.nm.us

Shafiq Chaudhary, Math and Science Specialist
505–827–6511
shafiq.chaudhary@state.nm.us
Final Reflection

What are the possibilities for learning in a NM STEM Ready! science classroom?
References


- [https://www.nextgenscience.org/parentguides](https://www.nextgenscience.org/parentguides)
