A Closer Look at NGSS
Grades K-2

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Session Objectives

- Develop an Understanding of NGSS Performance Expectations
- Use one example as a model for learning
Locate K-2 Standards  
(NGSS Topics)

Grade K

- **K. Forces and Interactions: Pushes and Pulls**
- **K. Interdependent Relationships in Ecosystems: Animals, Plants, and Their Environment**
- **K. Weather and Climate**

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Locate K-2 Standards
(NGSS Topics)

Grade 1

- 1. Waves: Light and Sound
- 1. Structure, Function and Information Processing
- 1. Space Systems: Patterns and Cycles

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Locate K-2 Standards (NGSS Topics)

Grade 2

- 2. Structure and Properties of Matter
- 2. Interdependent Relationships in Ecosystems
- 2. Earth’s Systems: Processes that Shape the Earth

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Structure of NGSS

- Expressed as *Performance Expectations* (PEs)
- *Integrate* practices, core ideas, and crosscutting concepts
- Statements of what is to be *assessed*
- Require demonstration of *knowledge-in-use*
- NOT instructional strategies
- NOT lesson objectives
- State what students should be able to do at the *end of instruction*
- Organized by Topic and by DCI (See chart)
How to Read a PE

“NGSS Structure” Supporting document on NGSS page

http://www.nextgenscience.org/how-to-read-the-standards

Inside the NGSS Box – Content Description (NSTA)

http://nstahosted.org/pdfs/ngss/InsideTheNGSSBox.pdf
How to Read a PE

- Select one PE. **K-PS2-1** (In K. Forces and Interactions: Pushes and Pulls)

- Read the PE, the clarification statement, and the assessment boundary.

- Read the applicable DCI in the foundation box.

- Check *Appendix E* for DCI progression.
How to Read a PE

- Read the associated practice in the foundation box.
- Check Appendix F for Practice progression.
- Read the associated crosscutting concept (CCC) in the foundation box.
- Check Appendix G for CCC progression.

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Strategies for Planning Instruction

- Scaffold the development of understanding expressed in the PE(s).

- Develop a series of learning tasks that blend together various practices, core ideas, and CCC.

- Integrate.

- Consider prior knowledge.
  - Preconceptions and current understandings

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Developing a Lesson

K. Forces and Interactions: Pushes and Pulls

**Question 1:** What performance expectations are related and can be included in instruction within the lessons/unit? (Cluster PEs)
Developing a Lesson:
K. Forces and Interactions: Pushes and Pulls

- Performance Expectations:
  - 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.
  - 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.*
Developing a Lesson
K. Forces and Interactions: Pushes and Pulls

Question 2: What are the performance expectations’ clarification statements and assessment boundaries and how are they related in terms of instructional practices?
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K. Forces and Interactions: Pushes and Pulls

K. Forces and Interactions: Pushes and Pulls

- 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.
  - Think Aloud (Comments/Thoughts): Given the experiences and understandings that students have acquired about motion, they should be given a set of experiences that confront or challenge their thinking.
Developing a Lesson

K. Forces and Interactions: Pushes and Pulls

K. Forces and Interactions: Pushes and Pulls

- **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.

- Comments/Thoughts: Another possible problem could be to change direction/speed to travel to a specific destination.
Developing a Lesson
K. Forces and Interactions: Pushes and Pulls

• How are they related?
  • 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.
  • 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.*
  • Think Aloud: Through their ability to investigate, students recognize and gain understanding that different strengths of pushes and pulls affect motion in terms of speed and direction. Using their new knowledge, students make observations and collect data to determine if a design works as intended to change speed and direction of an object with a push or pull.

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K. Forces and Interactions: Pushes and Pulls

**Question 3:** What are the disciplinary core idea(s), practices, and crosscutting concepts coded to the performance expectations and how will they drive instruction?
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K. Forces and Interactions: Pushes and Pulls

Disciplinary Core Ideas:

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

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

- **PS3.C: Relationship between Energy and Forces**
  - A bigger push or pull makes things go faster.

- **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.

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Science and Engineering Practices:

• Asking questions and defining problems
• Planning and carrying out investigations*
• Analyzing and Interpreting data*
• Constructing explanations and designing solutions

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Cross-Cutting Concepts:

- Cause and Effect
- Simple tests can be designed to gather evidence to support or refute students’ different ideas about causes.

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K. Forces and Interactions: Pushes and Pulls

K. Forces and Interactions: Pushes and Pulls

**Question 4:** What understandings need to be developed for students to be successful in the performance expectation(s)?

What content ideas will they need to know and what skills will they need to learn?

Let’s make a list! What will they need to know and be able to do?
Developing a Lesson

K. Forces and Interactions: Pushes and Pulls

- Kindergarteners will need to understand:
  - a push and/or a pull as a force that affects motion.
  - that an object moves in the direction of the push or pull.
  - that pushes and pulls can speed up, slow down, or change the direction of an object.
  - that size, weight, and shape of an object affects its motion.

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K. Forces and Interactions: Pushes and Pulls

- Kindergarteners will need to be able to:
  - describe motion in terms of objects around it.
  - make observations of motion and generate questions about motion.
  - plan and conduct simple investigations into motion.
  - construct simple charts from motion data and observations.
  - share ideas about motion and communicate findings orally and through drawings and writings.
  - recognize patterns in the affect of pushes and pulls on objects.
  - gather information from books and one another.
  - demonstrate concepts of motion through illustrations and performances.
  - analyze a design in terms of its ability to change direction or speed of a moving object.
Developing a Lesson
K. Forces and Interactions: Pushes and Pulls

Question 5: What Science and Engineering Practices are appropriate with the instruction of the disciplinary core ideas?

(See Appendix F for description of Practices for the K-2 grade band.)
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K. Forces and Interactions: Pushes and Pulls

• Science and Engineering Practices:
  • Asking questions and defining problems
  • Planning and carrying out investigations*
  • Analyzing and Interpreting data*
  • Constructing explanations and designing solutions

• What do these practices look like at the K-2 level?

• Will students be engaging in Practices not attached to the PEs?

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K. Forces and Interactions: Pushes and Pulls

Question 6: What are the lesson level expectations (learning performances) and how will they build to meet the performance expectations?

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K. Forces and Interactions: Pushes and Pulls

- Lesson level expectations:
  - Share ideas about motion and communicate prior understanding.
  - Make observations of motion and communicate findings based on observations. Raise questions about motion.
  - Plan and conduct simple investigations into motion.
  - Demonstrate pushes and pulls as necessary forces to start an object in motion.
  - Relate informational text regarding motion with motion investigations and observations in the classroom.
  - Make purposeful observations of a variety of objects in motion and identify patterns in motion of variety of objects.
  - Design and analyze a device that will change the motion or speed of an object.

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K. Forces and Interactions: Pushes and Pulls

Question 7: What assessment (formative and summative) will provide evidence of the understanding and/or ability to perform lesson level expectations (learning performances)?

Make a list of assessment ideas (formative and summative).
Developing a Lesson

K. Forces and Interactions: Pushes and Pulls

• **Assessment:**
  • Students draw and use approximation of writing to record observations and understandings.
  • Student interviews and oral presentations of findings and understandings.
  • Whole class discussion, written responses, and interviews regarding response to informational text and relation to classroom activities.
  • Student demonstrations and written and oral explanations of investigations and findings.
  • Student demonstrations and written and oral explanations of engineering designs to change the motion of an object.
  • Student design of devices and objects.

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K. Forces and Interactions: Pushes and Pulls

**Question 8:** What is the storyline that helps learners apply what they know, build new, sophisticated ideas from observation and evidence, and use information to solve an engineering problem?
Developing a Lesson
K. Forces and Interactions: Pushes and Pulls

- **Storyline:**
  - This is where you begin to see the “movie” in your head.
  - What are the students doing in each lesson/activity?
  - How does each new lesson/activity build on the previous?
  - Once upon a time there was a 5 year old that was very excited to attend Kindergarten. The teacher told the child that the class would be exploring the motion of objects. “First,” the teacher said, “you will be given the opportunity to...”

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K. Forces and Interactions: Pushes and Pulls

**Question 9:** How do the lessons and tasks help students move towards an understanding of the performance expectation(s)?
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K. Forces and Interactions: Pushes and Pulls

- Moving Toward Understanding:
  - The sequence of lessons engages students directly with objects in motion and through text in the cause and effect of forces (pushes and pulls) and motion.
  - Through experiences, investigations, analysis of observations and results, students gain sufficient knowledge and skill (practices) to be able to analyze an engineering device for its ability to change the speed or direction of an object in motion.

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And at the end of the lessons, the five year old said, “Let’s do it again, only this time....”
For More Information

All NGSS official documents are available at

http://www.nextgenscience.org/

NGSS at NSTA

Standards and Supporting Materials Tab

http://www.nsta.org/about/standardsupdate/standards.aspx
For More Information

- All of today’s session materials will be available at

http://ngss-michigan.org/
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Developed for the Introduction to the Next Generation Science Standards, Michigan State University, May 28, 2013