Knowing Science Approach to Three-Dimensional Assessment

“To be science literate is to be able to see how and why science and engineering really matter, to know how to reason from evidence, and to have a sense of how scientists and engineers do what they do”.
- from Seeing Students Learn Science by Alexandra Beatty and Heidi Schweingruber

Knowing Science believes that assessment should be as stress-free as possible. Our goal is three-fold: to make the learning process fun as well as “functional”, to teach students how to communicate and work collaboratively in the same manner that real-world scientists and engineers do, and to build confidence in their learning and problem-solving abilities.

Features of our assessments:

- **Instructional Coherence**
  The Knowing Science curriculum is purposefully designed to promote consistency in learning, both across and between grade levels. All lessons and assessments are aligned to NGSS performance expectations and evidence statements. Since they follow K-2 and 3-5 Progression Charts outlined in the NGSS, lessons and assessments build in complexity. This ensures logical and coherent development of 3-dimensional learning.

  Assessment tasks are authentic. Tasks present students with real-world situations that require them to apply 3-D learning (Disciplinary Core Ideas, Crosscutting Concepts, and Science and Engineering Practices). Both formative and summative assessments are grounded in classroom instruction. Assessments are based on learning experiences and activities covered during Physical Science, Life Science, and Earth and Space Science lessons. This provides consistency in learning for students and allows them to build on prior learning.

  Lessons and assessments are further supported by alignment with Common Core ELA Standards. Student collaboration and communication expectations are based on Common Core Speaking and Listening Standards (http://www.corestandards.org/ELA-Literacy/SL/). Responses to learning tasks incorporate literacy skills that are aligned both with Reading Informational Text Standards (http://www.corestandards.org/ELA-Literacy/RI/) and Writing Standards (http://www.corestandards.org/ELA-Literacy/W/).

  These literacy standards are the foundation of the Science and Engineering Practice of Obtaining, Evaluating, and Communicating Information which states, Scientists and engineers must be able to communicate clearly and persuasively the ideas and methods they generate. Critiquing and communicating ideas individually and in groups is a critical professional activity (https://ngss.nsta.org/Practices.aspx?id=8). This practice places an emphasis on reading, writing, communicating and presenting information using domain-specific science and engineering language.
**Collaboration and Communication**

Knowing Science places great value and emphasis on developing collaborative skills. Students work in partners or small groups to complete investigations and performance-based tasks. Working in small groups lays the foundation for collaboration that mirrors how “real world” scientists and engineers work. It encourages development of speaking and listening skills necessary for productive learning conversations.

At the beginning of a lesson, working in small groups allows students to share ideas and prior experiences with the topic. As students explore new concepts through shared learning experiences, they generate descriptions and explanations using their own language. Throughout the lesson, group work allows students to continuously revise ideas and refine the language they use to describe their learning using more “precise” terms (domain-specific vocabulary). At the application level, collaboration allows for further testing and sharing of ideas.

Collaboration during summative performance tasks allows students to access and build upon the group’s cumulative ideas that have developed throughout the lesson. While students complete the actual task and share task-related knowledge in small groups, they are still responsible for submitting an independent task response that shows evidence of their individual understanding.

**Multiple Assessment Options**

A variety of formative assessments are embedded in instruction which measure 3-Dimensional learning over time. Informal formative assessments such as teacher observation, questioning, and reflective conversations provide “real time” information about student understanding during learning experiences and activities. Guiding questions keep students focused on target concepts for that session, facilitate conversations around the activity, and help the teacher gather information about student understanding to plan future learning.

Formal formative assessments include a variety of student work products such as sketches, diagrams (or other models) exit tickets, or any other type of written response. These student products may be completed individually or as a collective response. Teachers gather and review student responses, and then use information gained from the responses to guide future learning. Student products indicated with a (*) on the lesson evaluation rubric (and also in the Teacher Manual) may be used as evidence of learning progress and student understanding.

Summative assessments are performance-based and include multiple components occurring over two to three sessions. Students work in groups to conduct an investigation where they have the opportunity to collaborate and discuss their thinking. During the investigation they use a combination of practices, reasoning, problem solving, and communication skills. Students are expected to provide complete and accurate documentation of their thinking during the investigative process and are required to complete an individual response that allows the teacher to assess growth in learning. Additional optional assessment questions may include short answer, constructed, open-ended or extended responses.
• **Flexible Response Formats**

  Knowing Science lessons and assessments allow for multiple means of responding to learning, based on developmental stages, student learning styles, and management considerations.

  **Verbal responses:** Sharing ideas with others is powerful. Students are excited when they “get” the same results as other students. They are reassured when they experience similar difficulties or unexpected results as others did and can then suggest solutions. This exchange of information fosters collaboration, which is at the heart of any scientific or engineering investigation.

  **Vocabulary:** It is not necessary for students to master topic-specific vocabulary when first learning about a topic. It is necessary for them to discuss their ideas. Teachers are encouraged to initially accept students' own vocabulary, explanations, and descriptions of ideas. The teacher then engages in reflective conversation to encourage use of specific vocabulary and more precise terms. One technique to promote vocabulary development is to utilize topic-specific vocabulary, paired with student language, when restating a student question or observation. As students gain a deeper understanding of the topic, they will then begin to use specific vocabulary to better express their ideas.

  **Written responses:** Use graphic organizers, K-W-L charts, chart paper lists, or other electronic means to record and display the group’s ideas as an activity, lesson, or investigation progresses. Choose the format that works best with your class.

  Use a scientists' journal or notebook. These may take a generic or structured format, depending on the age, abilities of students and the core concepts being investigated. For younger children, using a common, structured format ensures that every student is physically looking at and responding to their learning in the same manner. Folded or shape books help organize thinking in a fun way.

  As students gain greater control over written language, utilize informational response formats that mirror informational text structures. These responses include but are not limited to: description, comparison, cause and effect, sequence, process and change over time.

  **Visual, graphic, or illustrative responses:** These include but are not limited to: sketches, diagrams, charts, tables, graphs, photographs, and videos. Responding through sketching is a unique response format because every child can learn to draw to demonstrate understanding. Students who have difficulty expressing themselves through written language or verbal language can have great success when drawing to express their learning and ideas. As with written responses, scientific sketches allow students to show several types of comprehension that include but are not limited to: observation/description, diagrams, comparison, cause and effect, sequence, process, and change over time.

• **Evidence and Rubric-Based**

  Students have access to age and grade-appropriate task rubrics for performance assessments. These student-friendly rubrics make both primary and intermediate-age students aware of task criteria, which they may reference during their work and then use for self-reflection and self-assessment at the end of the task.
Teacher-oriented rubrics are used throughout the lesson to evaluate student understanding of disciplinary core ideas, crosscutting concepts, and science and engineering practices as learning progresses. This allows the student multiple opportunities to demonstrate understanding of concepts.

Gathering evidence of understanding is simple for teachers. Students produce a variety of work throughout the lesson that demonstrates evidence of concept development. Teachers may use any or all products indicated with a (*) on the lesson evaluation rubric and in the Teacher Manual to show evidence of learning progress.

Criteria for rubric scoring is as follows: Full Understanding, Partial Understanding, Limited Understanding. While this method of scoring is consistent between grade levels, students are assessed on tasks specifically related to Performance Expectation aligned Disciplinary Core Ideas, Crosscutting Concepts and/or Science and Engineering Practices.

In Conclusion:

Every effort is made in the Knowing Science program to create relevant, fun, and purposeful assessments for students. Collaboration gives students a glimpse into the world of real life scientists and engineers and how they work. Working with other students also takes the stress out of the assessment process. By making assessment less stressful and more interesting for students, the process should be easier for teachers.
<table>
<thead>
<tr>
<th>5E Lesson Design</th>
<th>Science/Engineering Concepts</th>
<th>Communication and Collaboration</th>
<th>Teacher's Role/Assessment Opportunities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engage</td>
<td>• captures student interest</td>
<td>• work in partners or small groups to share ideas, interests, and any prior experience with concepts</td>
<td>• observe interactions, listen to conversations, ask questions to determine prior knowledge or experience with concepts</td>
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<td></td>
<td>• presents anchoring question or phenomenon</td>
<td>• set expectations for communication and collaboration (ELA)</td>
<td>• starting point to help students build an accurate and complete understanding of desired learning concepts (informal formative)</td>
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<td>• activates prior knowledge</td>
<td>• lays the foundation for collaboration that mirrors how “real world” scientists and engineers work</td>
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<td>• connect with new concepts through common and equitable experiences</td>
<td>• lays the foundation for collaboration that mirrors how “real world” scientists and engineers work</td>
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<td>Explore</td>
<td>• opportunities for students to experience new concepts with common group experiences</td>
<td>• take together to generate descriptions of experiences with concepts <strong>using their own words</strong></td>
<td>• teacher carefully guides/facilitates student learning</td>
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<td></td>
<td>• foundational understanding develops with students assigning meaning to concepts through carefully guided activities</td>
<td>• students may begin to describe experiences with more “precise” vocabulary</td>
<td>• informal formative (“real time”) assessment: observation, conversation, questioning during learning experiences and activities</td>
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<td>Explain</td>
<td>• concepts are further developed, linking student experiences and language with “conventional” terms and vocabulary</td>
<td>• continue to work together to develop, compare and refine ideas</td>
<td>• multiple formal formative tasks demonstrate understanding (exit tickets, models, written responses)</td>
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<td></td>
<td>• student experiences and language are paired with more precise science and engineering terms (vocabulary)</td>
<td>• student experiences and language are paired with more precise science and engineering terms (vocabulary)</td>
<td>• student responses may be collaborative or individual</td>
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<td>Elaborate</td>
<td>• students apply knowledge of concepts and skills in a new situation to develop a deeper understanding of concepts</td>
<td>• work in partners/small groups to apply knowledge</td>
<td>• combination of informal (to determine understanding of new application) and formative assessments (written products)</td>
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<td>• collaboration allows for further sharing of ideas and applications</td>
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<tr>
<td>Evaluate</td>
<td>• students provide evidence of understanding of concepts and skills (DCI, CCC, SEP)</td>
<td>• work in partners or small groups to complete a performance-based summative assessment task</td>
<td>• students complete the task and share knowledge in partners or small groups, but are responsible for providing their own work to show evidence of individual understanding</td>
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<td></td>
<td>• summative task builds on formative tasks and learning experiences from earlier in lesson</td>
<td>• collaboration allows for access to cumulative ideas from entire lesson and all related learning experiences</td>
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Kindergarten Physical Science  Forces Assessment Sample

Standards Addressed/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.
Crosscutting Concept: Cause and Effect
Science and Engineering Practice: Planning and Carrying Out Investigations

**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 pull.
Crosscutting Concept: Cause and Effect
Science and Engineering Practice: Analyzing Data

**Note:** This lesson has a very narrow focus in terms of the standards. The focus is taken from 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. Each learning experience, as well as the design task/investigation, has the same narrow focus, which is changing the speed/direction of an object with a push.

**Management Notes:** These sessions are designed for approximately 30 minutes each. Actual session length is flexible, depending on scheduling, available space, and level of student engagement.

Student collaboration is encouraged throughout this lesson. Communicating with peers is an integral part of any investigative or design process and reflects how scientists and engineers interact in an authentic setting. Sharing ideas leads to refinement of conceptual thinking and improved designs. Students are observed in a group setting and are assessed on their communication skills, participation and ability to problem solve through collaboration.

Even though collaboration is emphasized, students are responsible for completing activity sheets and assessments independently. This allows the teacher to assess individual student progress.

**Guiding Questions** are designed to facilitate conversations around the activity and keep students focused on the target concepts for that session.

**Student Activity Sheets** are provided for students to record their observations and ideas. Use them individually or stapled together in a Student Activity Book format. Using journals is an additional alternative. If this is preferred, use the Guiding Questions are provided as journal prompts. Work from the Student Activity Sheets or journal may be used as formative or summative evidence of learning. Suggested evidence is indicated by a (*).
Learning Progressions:

**K-2:** Students in Kindergarten explore these three Disciplinary Core Ideas using familiar objects. The goal is to establish foundational knowledge on which to build in later grades.

- **Forces and Motion (PS2.A):** Pushes and pulls can have different strengths and direction and pushing/pulling on an object can both start or stop and object as well as change the speed or direction of its motion.
- **Types of Interactions (PS2.B):** When objects touch or collide, motion changes
- **Relationship Between Energy and Forces (PS3.C; secondary):** A stronger push/pull changes the speed of an object.

**3-5:** Students in grade 3 further explore Forces and Interactions in terms of balanced and unbalanced forces and objects that move in predictable patterns (such as pendulums, see-saws, and playground swings). They explore non-contact forces such as static electricity and magnetism. Students in grade 4 expand on the idea of forces and the relationship between force and energy (relating to speed and collisions; 4-PS3-1 and 4-PS3-3).

**6-8:** Looking ahead, students at this level build even further on these core ideas as they learn about Newton’s Third Law of Motion and relationships between force and the mass of an object. They continue to investigate electric, magnetic (electromagnetic) and gravitational forces.

Background Information and Lesson Overview:

**Sessions 1-5:** These sessions focus mainly on K-PS2-1. Students are presented with Scooter Squirrel’s Shopping Cart Dilemma phenomenon, which they will return to at the end of the lesson as a performance task. They learn the concept of force as a push or a pull and find examples of each in their everyday lives. Through guided investigations, students learn about the effects of different strengths and directions of force when applied to familiar objects.

**Sessions 6-9:** These sessions build on ideas developed in the first part of the lesson and continue with the concept of how force can change the speed or direction of an object. Students participate more in the planning investigations and learn how to analyze data that helps to support and explain their solution ideas.

The final performance/evaluation task, Scooter Squirrel’s Shopping Card Dilemma, revisits the phenomenon. Students use learning acquired during the lesson to help solve Scooter’s problem.

**Session 10 (optional):** What is Motion? provides an additional opportunity for students to demonstrate understanding of what they learned over the course of the lesson with regard to forces, including the meaning of pushes and pulls, more or less relative force, and the relationship between mass, speed, and force.

**Assessment:** Student progress may be assessed in several ways. Evidence may be collected from the Student Activity Sheets/Book (or journal pages) as indicated with a (*) in the teacher manual and on the Forces Lesson Assessment Rubric.
The final performance task, *Move the Box/Scooter's Shopping Cart Dilemma* serves as a summative assessment task for the lesson. Students apply knowledge of what they learned to carry out an investigation, collect data, and use evidence-based conclusions from the investigation to address the problem presented in the anchoring phenomenon.

The additional optional summative assessment task, *What is Motion?* asks students to make a sketch (or sketches) that reflects what they learned during the lesson. It is purposely left open-ended.

Use the *Forces Lesson Assessment Rubric* throughout the unit to evaluate student understanding of disciplinary core ideas, crosscutting concepts, and science and engineering practices. This allows the student multiple opportunities to demonstrate understanding of concepts.

**5E Lesson Design:**

**Engage:** captures student interest with an anchoring question or phenomenon, activates prior knowledge and experiences, and provides an opportunity to connect with new concepts.

**Explore:** opportunities for students to experience the new concept with common group experiences, and to work together to generate descriptions of these experiences using their own words.

**Explain:** concepts are further developed, linking student experiences and language with “conventional” terms and vocabulary.

**Elaborate:** opportunities for students to apply knowledge of concepts and skills in a new situation in order to develop a deeper understanding. Students continue to work together to discuss and compare their ideas.

**Evaluate:** opportunities for students to provide evidence of understanding of new concepts and skills.

**Vocabulary (taught in context of sessions as concepts develop):**

-Collide- direct contact where two or more bodies exert force on each other

-Data- information gathered from observations

-Direction- pathway of movement/motion

-Distance- amount of space between two points

-Force- push or pull

-Motion/Movement- change in physical location or position

-Position- location of an object

-Pull- force that moves an object toward
Push - force that moves an object away

Relative Position - describing the location of an object in relation to another object (ex: on top of the desk)

Speed - measure of how fast an object moves

Strength - amount of force (relative)

Extending the Lesson:

1. Explore the game of bowling with a commercially-purchased student set or simply with tennis balls (or other types of balls on hand) and water or soda bottles filled with water or sand.
2. Set up an exploratory center for students to experience various types of objects needing a push or a pull, such as any type of ball, vehicle (cars, trucks, pull-back cars), or other classroom toys (any toys with wheels, spinning toys, or windup toys).
3. Take a “field trip” to the school playground to further investigate which equipment moves with a push, a pull, or both. Students often play on the equipment without stopping to think and name the forces used as they play. (This concept is introduced in Session 2.)
4. If students are familiar with the game of kickball, play a “modified” game where they stop to identify any pushes and pulls used during the game.
5. Art project: painting with marbles. Place a piece of paper in a shallow tray or box lid. Fill muffin tins or other shallow cups with a small amount of paint. Drop a large marble in. Take it out and roll it around on the paper.
6. Explore with dominoes, either regular sized or extra-large sized. Set up short domino runs (less than 10) and gradually work up to more.
7. Purchase or mix up a batch of bubble solution. Use bubble wands or even hands to explore pushes and pulls with bubbles.
8. Explore the concept of friction by rolling balls or vehicles on various surfaces: smooth tabletop or floor, carpet, sandpaper, or bubble wrap. Note that this concept is formally introduced at the middle school level, but it is nonetheless part of our everyday lives.
Sessions 8-9: Summative Performance Task
Move the Box/Scooter’s Shopping Cart Dilemma

Evaluate: opportunities for students to provide evidence of understanding of new concepts and skills.

Learning Experience Summary: Students solve a task that simulates Scooter’s stuck shopping cart problem, and then give advice to the squirrel about what to do to solve the problem and explain why their solution works.

Session 8: This first session is activity-based. Since the underlying concept in this task is similar to previous tasks, student should have an idea about how they will solve Scooter’s dilemma (using greater force). They may or may not be ready to collect data during the first session.

Session 9: This session should be mostly spent in recording and analyzing data (if not done in the previous session) and completing a solution sketch. Depending on the productivity level of your students, it is possible that a third session may be needed for finishing and presenting solutions.

Guiding Questions:

- Why is Scooter having problems pushing the cart?
- What’s the best way to move the box (without touching the box with your hand)?
- Explain why the solution to move the box works. Use data as evidence.
- What advice can we give Scooter about what to do to help push the cart and get it “unstuck”?
- How can we explain this to Scooter using “scientific” language?

Materials (for each small group):

- Small box to represent Scooter’s shopping cart (decorating optional)
- Choice of balls: tennis, golf, wiffle golf, ping pong
- Ramp (grooved ruler or student choice)
- Books/blocks to raise ramp 2 ½”-5”
- Sticky notes, masking tape or colored dots (for relative measurement)
- Image: Scooter Squirrel’s Shopping Cart Dilemma
- Session 1: I Notice/I Wonder Chart
- Activity Sheet 7: Move the Box Data Collection Sheet(*)
- Activity Sheet 8: Scooter Squirrel’s Shopping Cart Solution(*)
- Optional: tape measure or meter stick (for actual measurement)
- OWL Chart

Activities:

1. Move the Box/Scooter Squirrel’s Shopping Cart: Revisit the anchoring phenomena of Scooter Squirrel’s Shopping Cart Dilemma. Display the image and the I Notice/I Wonder Chart from Session 1. Help students read through the list of ideas they made when introduced to the anchoring phenomenon. Talk through their ideas and decide,
collaboratively, which ideas might be helpful for Scooter Squirrel and his shopping cart issue. Highlight these ideas in some way.

2. **Management options** are similar to those used in Session 6 Knock Over the Block, depending on the management needs and independent abilities of your students.
   - Open-ended approach: students to choose materials (balls) and approach (ramp vs. no ramp)
   - Ramp vs. roll (variable); use the same ball (i.e. tennis ball only)
   - Ramp only; choose at least two balls to compare (variable)
   - No ramp; choose at least two balls to compare (variable)

3. **Measurement options**: Depending on how much experience your class has with measurement, you have option of using colored dots, tape or sticky notes to show how far the shopping cart (cardboard box) has moved with each try or using a tape measure or meter stick to record actual numerical distances.

4. **“Must-haves”**: mark the placement of the box for each attempt. If students use the “roll” approach, mark the release point/ “starting line” for the ball. There should be some space between the release point of the ball and the placement of the shopping cart/box; exactly how much is part of the investigation.

5. Provide small groups with: a box, balls, blocks and a ramp. Students work collaboratively to design a solution to help move the box, using what they have learned about pushes, force, weight, and direction of movement. They need to determine a way to collect and analyze data to determine the effectiveness of their solution.

6. **Data Collection**: Use Activity Sheet 7: Move the Box Data Collection Sheet. Students collect data on the provided sheet. Again, suggest that they use an approach similar to Activity Sheet 5: Knock Over the Block Data Collection Sheet. Give 10 stickers to each small group. After a few practice “tries”, have students place a sticker under the heading to indicate whether the shopping cart/box moved or did not move. Inform them that a “miss” does not count in their ten rolls. The ball has to make contact with shopping cart/box

7. **Follow Up**: Each student provides an individual scientific sketch on Activity Sheet 8: Scooter Squirrel’s Shopping Cart Solution. Students may collaborate regarding what to draw, but each student should complete their sketch independently. Each group provides an evidence-based verbal explanation of their solution and why it works, including any changes they had to make during the investigation (what did not work and adjustments they made). They then give any advice to Scooter and why their solution would work for him to get his shopping cart moving again.
Session 10: Optional Written Summative Assessment Task
What is Motion?

Evaluate: opportunities for students to provide evidence of understanding of new concepts and skills.

Learning Experience Summary: This summative written assessment allows students the opportunity to demonstrate what they learned over the course of the lesson with regard to forces, including the meaning of pushes and pulls, more or less relative force, and the relationship between mass, speed, and force.

Guiding Questions:
- How can you tell if something is moving or “in motion”?
- How can you make things move?
- In what way does this/that (object) move?
- Why do you think that moves the way that it does?

Materials (for each small group):
- OWL Chart
- Activity Sheet 9: How do things move?

Activities:
1. Gather students and review the OWL Chart, starting with the Wonder questions in the middle column. Review each one and have a brief discussion about which ones have been answered and how. Highlight those that have been answered. Some questions may not have been answered during the lesson. These can be set aside for further investigation at some point, either formally as a group, informally, or not at all, depending on student interest and available time.

2. Refer to the anchoring question, “How do things move?” Distribute Activity Sheet 9: How do things move? Tell students that they will have the opportunity to draw what they have learned about forces throughout the unit. Review the O and L columns of the OWL chart to give students about what they might draw. Keep it as open-ended as possible to give students freedom of choice in how to process their learning.

3. Students may use the space on the sheet in as they wish. Some may draw one large picture, some may draw several smaller pictures in the one larger space, and some may choose to divide the large panel into smaller panels.

4. Allow students to brainstorm in collaborative groups or partners about what they might draw. Again, dialogue before drawing helps students mentally plan their ideas before putting the pencil to the page. If there are enough helpers, they may act as scribes as students draw, adding labels or brief sentences or phrases as students work.
Student Name: __________________________         Gr K Forces Assessment Rubric

Use this rubric throughout the lesson to assess understanding of concepts as they develop.
(*) Indicates student work products that may be used for assessment purposes.

<table>
<thead>
<tr>
<th>Standards/Activities/Sessions</th>
<th>Full Understanding (3 points)</th>
<th>Partial Understanding (2 points)</th>
<th>Limited Understanding (1 point)</th>
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<tbody>
<tr>
<td><strong>K-PS2-1:</strong> 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. CCC: Cause and Effect; SEP: Planning and Carrying Out Investigations</td>
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<tr>
<td>Session 2: Motion Hunt(*)</td>
<td>Sketches are clear and accurate; include additional details/information.</td>
<td>Sketches are complete and accurate.</td>
<td>Sketches lack detail, are incomplete or inaccurate.</td>
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<td>Session 3: Push/Pull Hunt(*)</td>
<td>Sorts push/pull accurately and independently.</td>
<td>Sorts push/pull accurately and will little support or prompting.</td>
<td>Sorts push/pull cards inaccurately and/or with considerable support and prompting.</td>
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<td>Session 4: Bean Bag Target Toss (*)</td>
<td>Accurately matches strength arrows with illustrations; includes additional details.</td>
<td>Accurately matches strength arrows with illustrations.</td>
<td>Inaccurately matches strength arrows with illustrations.</td>
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<tr>
<td>Session 5: Ball and Ramp (*)</td>
<td>Makes relevant and accurate contributions to shared explanatory drawing; offers additional details.</td>
<td>Makes relevant and accurate contributions to shared explanatory drawing.</td>
<td>Makes few or inaccurate contributions to shared explanatory drawing.</td>
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| **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 pull. CCC: Cause and Effect; SEP: Analyzing Data |
| Sessions 6-7: Knock Over the Block (*) (also K-PS2-1) | Presents data-based evidence that support conclusions; includes additional details. | Adequately presents data-based evidence that support conclusions. | Has difficulty making connections between conclusions and data-based evidence. |
| Sessions 8-9: Move the Box/ Scooter’s Cart Design Task (*) | Solution and evidence-based explanation exceptionally complete and accurate. | Solution and evidence-based explanation complete and accurate. | Solution and evidence-based explanation incomplete and/or inaccurate. |
| Session 10 (optional summative): What is Motion? (*) | Sketches are clear and accurate; include additional details/information. | Sketches are complete and accurate. | Sketches lack detail, are incomplete or inaccurate. |

| **ELA SL.K.1, SL.K.3, SL.K.4, SL.K.6:** Follows rules for discussions; asks/answers clarifying questions; makes relevant contributions to conversations; give clear explanations with supporting details |
| Ongoing throughout lesson | Works collaboratively and productively with no teacher prompting. | Works collaboratively and productively with minimal teacher prompting. | Needs considerable prompting to work collaboratively and productively. |

TOTAL POINTS:
Comments: _____________________________________________________
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________
Anchoring Phenomenon: Scooter Squirrel’s Shopping Cart Dilemma

Photograph by Craig Doogan
Name ________________________________           Activity Sheet 7: Move the Box Data Collection Sheet

Directions: Roll the ball 10 times. Place a sticker to show if the box moved or not. Misses do not count in your 10 “tries”.

[Diagram of balls and boxes with a checkmark and an X]
Directions: Draw a sketch of your ideas. Show Scooter how to get the shopping cart “unstuck”.
Activity Sheet 8: Scooter Squirrel’s Shopping Cart Solution

Directions: Draw a sketch of your ideas. Show Scooter how to get the shopping cart “unstuck”.

Name _____________________________________
Activity Sheet 9: How Do Things Move?

Directions: Draw to show what you have learned about force, pushes, pulls, and how things move.