Apple on the Desk Lesson Plan
Lesson adapted from Keeley, P., Eberle, F., & Dorsey, C. (2008). Uncovering Student Ideas in Science (Vol 3). Arlington, VA: NSTA Press.
Red was added in the second iteration of the lesson.

ENGAGE: ***Connect to Prior Knowledge and Experience, Create Emotionally Safe Learning Environment, Preview New Vocabulary*** **Estimated time: 10 minutes**		
Teacher's Role	**Teacher Questions**	**Children's Role**
1. Teacher places an apple on the teacher's desk then enacts Probe 8: *Apple on a Desk* [L1] to determine what children know about forces. 2. Have students read aloud each statement by the students in the scenario. As each statement is read aloud, have other students help you rephrase, summarize, and write on board what that means. Teacher walks around the room and reads student responses quietly without talking to children. In particular, teacher looks at children's drawings for insight into student thinking.	2. From probe: Which student do you most agree with? Explain your thinking.	2. Children read the statements. They rephrase or summarize what each statement means. Children respond in writing individually without talking to an elbow partner. **(SEP 6; ELD C10; ELA CCR R1, R8, W1; CCSS.ELA-LITERACY.RI.3.1, 3.8; CCSS.ELA-LITERACY.W.3.1)** **Naïve conception:** Some children think that if an object is not moving, there is no force acting on it. **Naïve conception:** Children have difficulty understanding that all interactions involve equal forces acting in opposite directions on the separate, interacting objects.

EXPLORE: ***Hands-On Learning, Contextualize Language, Use of Scaffolding (Graphic Organizers, Thinking Maps, Cooperative Learning), Use of Multiple Intelligences, Check for Understanding*** **Estimated time: 30 minutes**

***Safety Note: Have students wear goggles when interacting with materials that may have unexpected motion, such as moving bricks, pennies, and index cards.**

Teacher's Role	**Teacher Questions**	**Children's Role**
1. Teacher asks the children to get into groups of 2 or 3. Teacher may select these groups or may have the children self-select. 2. Teacher models how to use the materials at each station without moving the objects so as not to spoil the surprise. Model how learners will reread the directions for clarification. See attached worksheet and directions pages. 3. Teacher walks around the room and listens to conversations or asks children questions. Teacher chooses a different group to describe the forces at each station in preparation for the Explain.	1. You will now observe different objects and will investigate forces using the materials at each station. What do you notice? 2. Follow the directions and make your observations. Perform the next investigation.	2-3. Children read the directions, investigate the materials, report to their partners, and write their observations on the graphic organizer. **(SEP 3, 8; ELD A1, A3, B5; C10, C11; ELA CCR SL1, SL2, SL3; CCSS.ELA-LITERACY.SL.3.1, 3.2, 3.3)**

EXPLAIN: ***Listening, Speaking, Reading, and Writing to Communicate Conceptual Understanding*** **Estimated time: 20 minutes**

Teacher's Role	Teacher Questions	Children's Role
1. Teacher tells groups to share their observations and findings. 2. Teacher listens to groups' reports and repeats or Revoices (one of the five productive talk moves) what they say to be sure that the class is noticing patterns and the learning is addressing the standards.	1. Each group will now tell us: a. what they observed at each station and b. what forces they think were acting on the objects at their station. 2. What evidence do you have to make that statement? 3. Do you think the forces are balanced or unbalanced? How do you know?	1. Children in their groups tell the whole class what they observed and what forces they think were acting on the objects. **(SEP 4, 7, 8; ELD A4, B5, C9, C11, C12; ELA CCR SL4, SL6; CCSS.ELA-LITERACY.SL.3.4, 3.6)** *Answers vary depending on the station.* **(SEP 7; ELA CCR SL3; CCSS.ELA-LITERACY.SL.3.3)** 3. *If the object did not move, the forces were balanced. If the object moved, the forces were unbalanced.* The children show the upward and downward forces with their hands. **(SEP 2)**
EVALUATE: ***Thinking Maps, Summarize Lesson and Review Vocabulary, Variety of Assessment Tools, Games to Show Understanding*** **Estimated time: 10 minutes**		
Teacher's Role	**Teacher Questions**	**Children's Role**

1. Teacher checks for understanding by asking questions, looking at responses, and looking at student responses.	1. Take out your probes now and look at the answer you gave earlier. Do you want to change your answer? If you do, cross out your answer. DO NOT ERASE!	1. Children revisit/reread their probes and decide whether they want to change their answer. They cross out any incorrect responses and write about their new understandings. DO NOT ERASE. **(SEP 4, 6, 8; ELD C10; ELA CCR W1; CCSS.ELA-LITERACY.W.3.1)**
2. Teacher uses Numbered Heads to call on certain members of each group.	2. Now what do you think that word "force" means? Talk to your partners.	2. 3. *A force is a push or a pull from an interaction between 2 objects.*
4. Teacher shares the "Farmer in the Dell" sentence frames.	4. Think of ideas in various parts of speech to match our learning today.	4-5. Children provide the words for the Farmer in the Dell then sing the sentences.
5. Teacher helps children to complete the Farmer in the Dell. Teacher scripts children's words.	5 Let's fill out the Farmer in the Dell then we will sing our sentences.	

EXTEND: *Group Projects, Plays, Murals, Songs, Connections to Real World, Connections to Other Curricular Areas*	**Estimated time: 5 minutes**	
Teacher's Role	**Teacher Questions**	**Children's Role**
1. Teacher connects the lesson to the real world by demonstrating the search for upward and downward forces at school (i.e. holding a ball at recess, noting the ball pushing down on a hand and the hand pushing up on the ball or playing hand games and pushing with varying forces).	1. When you leave the classroom, notice the objects and people around you. What forces are acting on them? Are the forces balanced or unbalanced?	1. Children notice objects and people around them. They note the forces they think are acting on these. They present their thinking and findings to others at home.

Teacher Background Information

Forces come in pairs. The force of gravity acting on the apple is the result of the matter in the Earth pulling on the matter in the apple. When the apple is set on the table, the table exerts a force upward on the apple equal to the force exerted downward, which is the pull on the apple. At a

microscopic level, when the apple is placed on the table, the individual molecules of the table's surface adjust their position in much the same way that the individual springs in a bedspring mattress change position to support a sleeping person. This force on the apple exists because the apple is in contact with the surface of the table. When the apple is removed, the molecules of the table return to their original positions, as happens when a sleeping person rises from the bed in the morning.

The fact that the apple is not moving indicates that another force besides gravity must be present. In order for any object's motion to remain unchanged, all of the forces on that object must balance. In the case of the motionless apple, the downward gravitational force is balanced by an upward force supplied by the only other object in contact with the apple—the table.

Air pressure also creates a force on the apple, but since air pushes on the apple almost equally in all directions, the effects of the air's force are not noticeable in this case (Keeley, Eberle, and Dorsey 2008, p. 64–65).

Apple on the Desk Station Directions

Task 1. Books on a Sponge

Put one book on the sponge and notice what happens to the sponge. Continue to put more books on top of the first book and notice the sponge each time. Discuss with your partners what is happening. Record your observations on the data table and draw what happened to the sponge as it pushed up on the books.

Task 2. Brick in Hands

Take turns holding the brick in your hands. What do you need to do to keep the brick steady and not moving? What happens if you push harder on the brick? What happens if you relax your muscles a little bit? Discuss these questions with your partners and record your observations in the data table.

Task 3. Penny and Card on a Cup

Cover the cup with the paper card and put the coin on top of the card. Is the penny moving? What do you think is happening?

Get the penny into the cup without lifting the card by "flicking" the card with your finger. Observe what happens to the penny and the card and discuss this with your partners. Write your observations in the data table.

Task 4. Penny on Ring on Bottle

Place the masking tape on the bottle so that it is supported vertically by the bottle. Put the penny on the top surface of the masking tape. Is the penny moving? What do you think is happening? Without touching the penny or the bottle, quickly move the masking tape aside to get the penny into the bottle. Observe what happens to the penny and discuss this with your partners. Write your observations in the data table. Draw what happened to the penny when you removed the ring that was supporting it.

Task 5. Books on Metersticks

Put the two metersticks side by side resting on 2 chairs. Put one book on the metersticks and notice what happens to the metersticks. Continue to put more books on top of the first book and notice the metersticks each time. Discuss with your partners what is happening. Record your observations on the data table and draw what happened to the metersticks as they pushed up on the books.

The Farmer In The Dell Activity

Article	**Adjective**	**Adjective**	**Noun**	**Verb**	**Adverb**	**Prepositional Phrase**
The	shiny	red	apple	pushes	down	on the table.

Documentation Sheet/Data Table to record observations in the investigations.

Task	**Materials**	**Observations**	**Drawing**
1	**bricks on a sponge**		
2	**brick in hands**		
3	**penny and card on a cup**		
4	**penny on ring on bottle**		
5	**bricks on meter sticks**		