Welcome to NSTA's Daily Do
Teachers and families across the country are facing a new reality of providing opportunities for students to do science through distance and home learning. The Daily Do is one of the ways NSTA is supporting teachers and families with this endeavor. Each weekday, NSTA will share a sensemaking task teachers and families can use to engage their students in authentic, relevant science learning. We encourage families to make time for family science learning (science is a social process!) and are dedicated to helping students and their families find balance between learning science and the day-to-day responsibilities they have to stay healthy and safe.

What is Sensemaking?
Sensemaking is actively trying to figure out how the world works (science) or how to design solutions to problems (engineering). Students do science and engineering through the science and engineering practices. Engaging in these practices necessitates students be part of a learning community to be able to share ideas, evaluate competing ideas, give and receive critique, and reach consensus. Whether this community of learners is made up of classmates or family members, students and adults build and refine science and engineering knowledge together.
Introduction

Many magic tricks are applications of science ideas performed with a flourish! The tablecloth trick is no exception. But how does the trick work? In today's task, *Why don't the dishes move?*, students engage in science and engineering ideas and use the thinking tool of cause and effect (crosscutting concepts) to make sense of science ideas about forces. Students use these ideas about forces to explain *how* the tablecloth and similar magic tricks work.

If you and your students love magic tricks and illusions, don't worry! The explanation of the tablecloth trick phenomenon won't diminish the trick's ability to impress and amaze.

The Tablecloth Trick

Tell students you saw a surprising phenomenon - a magic trick(!) - that you want to share. Ask students to create a t-chart in their science notebook or on a sheet of paper and label one side *notice* and the other side *wonder*.

Play the [tablecloth trick video](#) until you can see a clear image of the two tables like the one at left. Stop the video and ask students to individually record their observations and any questions that arise in their t-chart.

Play the video a two or three times while students continue to individually make and record observations. Consider playing the video at half speed (Settings > Playback speed > 0.5) a few times as well. You might also share [side-by-side images of the two tables before and after the trick](#) so students can make direct comparisons and record additional observations and/or questions.
Next, ask students to move into small groups (3 or 4 students) and share their observations. You might use a talking stick protocol (see the Why are plane designs so different? Daily Do) to help ensure each student has an opportunity to share.

Create a class notice-and-wonder t-chart. Ask each group to share two observations that most of the group noticed and one observation that maybe only one student noticed that was an "ooh, I didn't notice that" for everyone else. If a group also shares a question(s), make sure to record their question(s) on the t-chart. Observations and student questions may include:

- both tables have dishes, cups, vases, and coffee/tea pot Are they all empty?
- everything on the tables moved Why did they stay on the table?
- everything on the tables moved in the direction of the tablecloth Why didn't the tablecloth drag everything off the table?
- the tablecloth is shiny Does the type of table cloth matter?
- the magician pulled the table cloth Does how fast he pulls the tablecloth matter?
- some of things on the table moved further than others Why did some things move further than others? Did the things that move further weigh less? Were they empty?

Say to students, "Many of us are wondering why the objects on the table stayed on the table. Does it make sense to investigate this question first?"

**Coin in the Cup Investigation**

**PREPARATION**

**Materials** (per pair of students)

- paper card (playing card, stiff index card, etc.)
- cup (plastic or glass)
- penny

**Coin in Cup student handout**

Practice the Coin in the Cup trick before performing the trick for your students. Place the card on top of the glass and then center the penny on the card. Quickly flick the card with your forefinger in the horizontal direction (see set-up at right).

**INVESTIGATION**

Say to students, "I've seen a phenomenon related to the tablecloth trick which doesn't involve breakable dishes! Let me show you."
Perform the *Coin in the Cup* trick for your students. You might repeat the trick a few times. Ask students, "Do you think we can explain the trick using our knowledge about forces?" Project the first page of the student handout (or redraw on a poster, whiteboard, etc.). Do not distribute to students at this time.

Tell students, "At the start of the trick, what are the forces acting on the *penny*?" Ask students to turn and talk with a partner before asking students to share with the whole class. Students will likely say gravity is pulling downward and the card is pushing upward.

Draw an arrow representing the gravity on the top cup. Ask students, "How should I represent the force the card is exerting on the penny? (An arrow of the same size pointing in the opposite direction.) Why should the arrow be the same size? (The forces are balanced; there is no net force on the penny; the penny isn't moving.)"

Note: You might choose to label the downward arrow *weight* and the upward arrow *normal force* but students can explain how the trick works without this specialized language.

Next, ask students, "At this moment in the trick (point to middle cup), what are the forces acting on the *penny*?" Again, ask students to turn and talk with a partner before asking for students to share their ideas with the glass. Students will likely say gravity is the only force acting on the penny. (If students bring up air, suggest ignoring the effect of air because it is acting on the penny from all directions.)

Draw an arrow representing gravity on the middle cup. Then ask, "At this moment in the trick, what is the motion of the penny?" Students will likely say the penny is moving downward.

You might ask the students what forces are acting on the penny at the end of the trick and draw them on bottom cup.

Refer students back to the class list of observations and ask, "Does our explanation of the *Coin in the Cup* trick account for all of our observations?" Use the list to remind students that everything on the tables moved from their starting positions (even though they didn't fall off the table).

Say to students, "Lets see if we can use the materials from the *Coin in the Cup* trick to figure out why the table settings moved but didn't fall off the table."
Give every student a copy of the student handout and distribute materials to pairs of students. Challenge students to alter the trick to achieve each of the three additional desired penny outcomes. Make sure students individually record how they achieved each outcome.

As you move around the room, use questions to keep students thinking about the forces acting on the penny. Some questions you might ask include

- How is the motion of the penny different in this instance different from the motion of the penny in the Coin in the Cup trick?
- What forces are acting on the penny in this instance? Why do you say so? (If the penny is moving in a horizontal direction listen for students to account for a force in that direction.)
- What force(s) is acting on the penny in the horizontal direction?
- How is the force acting on the penny in the horizontal direction in this instance (point to an outcome) different from this instance (point to a different outcome)?

Give students time to achieve the desired penny outcomes but don't worry if not all students achieve all three. Collect all of the materials.

Project the following questions (or write on a poster, whiteboard, etc.) and ask students to answer them in the Alone Zone (independent thinking time)
1. Which of the four penny outcomes was closest to what you observed in the tablecloth trick?
2. In which case did the sliding card cause the greatest change in the horizontal motion of the penny?
3. In which case did the sliding card cause the least change in the horizontal motion of the penny?
4. Can you identify a pattern we could use to predict how far the penny will move in the horizontal direction when the card is slid beneath it?

Assign students to groups and ask them to share their answers to the above questions with the group. Listen for students to share ideas about the amount of time the sliding card applied a force to the penny and the penny's change in motion.

Bring the class back together. Say, "Can we come to consensus on the pattern we could use to predict how far the penny will move in the horizontal direction when the card is slid beneath it?"
Ask the group(s) who talked about the amount of time the horizontal force acted on the penny and the penny's change in motion to share their ideas with the class first. To bring the class to consensus, you might ask:

- Do we all agree with that? (If students don't agree, ask another group to share their ideas.)
- How are these explanations similar? How are they different?
- What modifications might you make to clarify confusion or address the discontent that this group feels?
- Are there still places where we disagree? Can we clarify these?

The class will likely reach consensus on the longer the sliding card applies a force to the penny, the further the penny will move in the horizontal direction. Consider sharing the Real Physics of the Tablecloth Trick with students after the class has reached consensus.
Direct students back to the class list of observations and questions and ask, "Which questions have we answered? Which question should we investigate next?" Consider performing the tablecloth trick once the class has figured out the answers to all of the questions!

**NSTA Collection of Resources for Today's Daily Do**

NSTA has created a *Why don’t the dishes move? collection of resources* to support teachers and families using this task. If you're an NSTA member, you can add this collection to your library by clicking ADD TO MY LIBRARY located near the top of the page (at right in the blue box).

**Check Out Previous Daily Dos from NSTA**

The NSTA Daily Do is an open educational resource (OER) and can be used by educators and families providing students distance and home science learning. Access the *entire collection of NSTA Daily Dos*. 