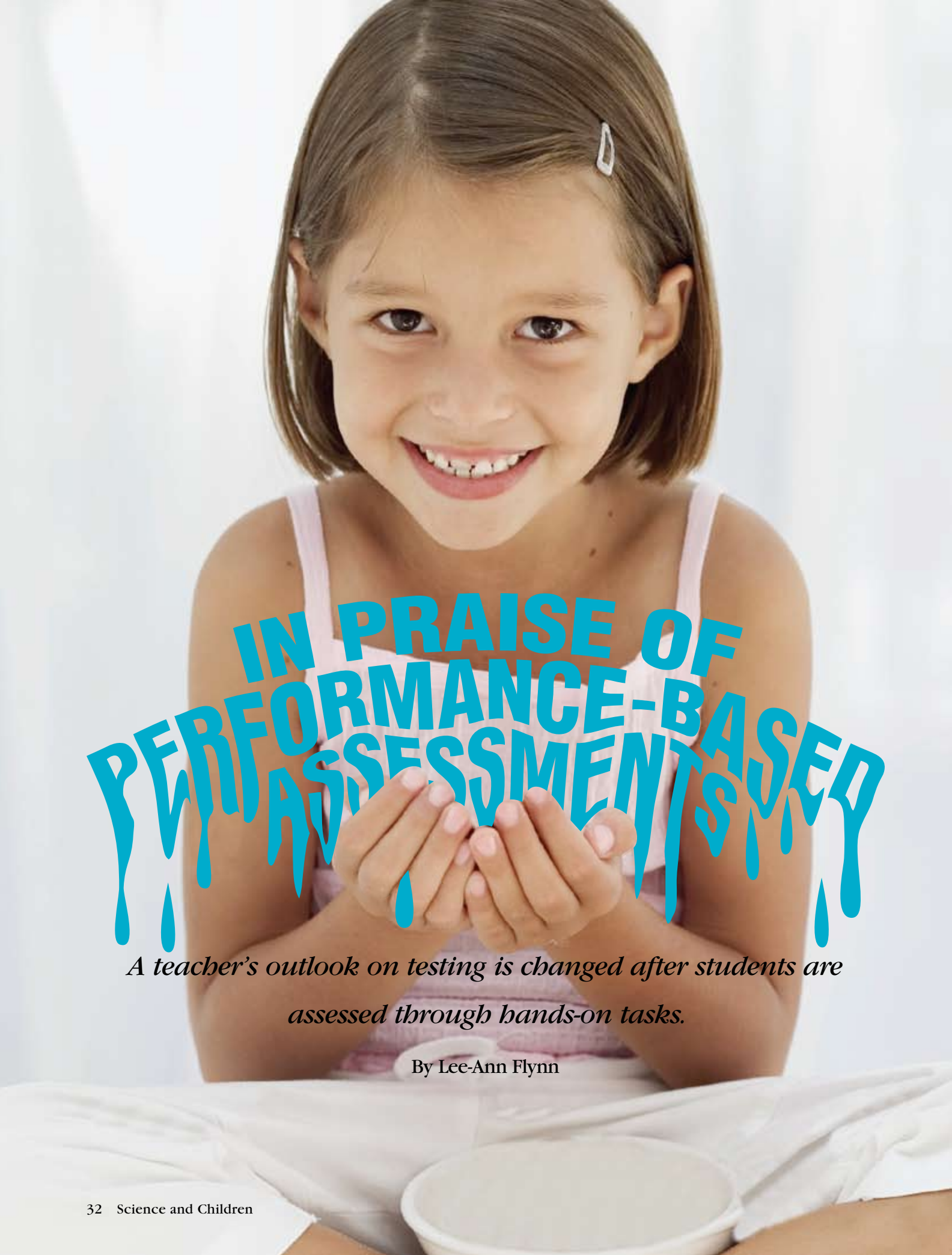

IN PRAISE OF PERFORMANCE-BASED ASSESSMENTS

A teacher's outlook on testing is changed after students are assessed through hands-on tasks.

By Lee-Ann Flynn

After 20 years of teaching, I had grown somewhat jaded by the onslaught of the high-stakes testing movement. So, when discussion at an organizational meeting turned to our state assessment test, I have to admit my mind was elsewhere—until the word *science* caught my attention—at first not in a good way. I feared my cherished subject would be taken hostage in the latest battle in the testing war. Our assistant superintendent sensed our uneasiness and promised to be there for us as we readied ourselves to deal with this new charge—performance-based assessments. We gathered our "light" reading on the topic and headed home. Her parting words, "I think you'll be pleasantly surprised," left me with hope. I dug in and read… and read…and read some more. It didn't sound so bad after all. Actually, it sounded great! This article describes the performance-based assessments I developed for use with second graders and the results in my classroom.

Figure 1.

Performance-based assessment rubric.

Assessment #_____

3 = Satisfactory 2 = Need Improvement 1 = Unsatisfactory

Completed investigation and wrote down information accurately
3 2 1

Clearly showed knowledge learned
3 2 1

Provided detailed descriptions using scientific terms
3 2 1

Made correct conclusion
3 2 1

Total points possible: 12 Total points earned: _____

Comments Section:
I really liked the way you did_____
Perhaps the next time you may want to try_____

Performance-Based Assessments

Performance-based assessments are tasks conducted by students that enable them to demonstrate what they know about a given topic. The difference between this type of "test" versus the traditional method is that students are given the opportunity to better communicate what they have learned.

Young scientists, for example, may not be able to repeat a lengthy definition. However, they *can* carry out an investigation and explain, in their own words, how and why it worked the way it did. That's the beauty of performance-based assessments—they focus on affording students the opportunity to apply their knowledge by engaging in tasks requiring critical-thinking strategies.

What I also loved about performance-based assessments was that they allow teachers to create tasks in different ways, i.e., some tasks that provide structure and direction and others that offer flexibility for the learner to work independently and explore based upon interest. This especially caught my attention because it was apparent how easy it would be to differentiate for my students with this type of testing model—all students could be given the same task, but how they chose to handle it would be their individual choice. They could still be taught to pose questions, collect and analyze data, and communicate what they have learned. With my renewed faith in the testing movement, I needed to take action and get down to business—I had performance-based assessments to create!

Being realistic, I selected *one* of my science units to conquer. The second-grade curriculum has a Solids, Liquids, and Changes unit that lends itself nicely to the performance-task format because it allows opportunities for students to explore how the structure of matter affects the properties and uses of materials. I was amazed how "teacher friendly" it was to develop this type of assessment. I began with a key organizing question.

The required content for this unit focuses on developing awareness that matter exists in three states—solid, liquid, or gas. Vocabulary terms were introduced to allow for a common understanding. Various investigations were conducted with an emphasis on the properties of each state of matter. When I first presented the performance assessment task to my students, I didn't even use the taboo word, "test." I didn't want to ruin it for them. I simply modeled each of the steps and allowed for natural discussion to occur. When I witnessed that a comfort level had been established, I let them in

on my little secret—this *was* a test! Once I felt that my students were ready to venture out on their own, I allowed them to complete the tasks. Being aware of the level of difficulty each performance-based assessment posed, I teamed my students up into cooperative groups—allowing peer instruction to take over. I milled about as the assessment unfolded and was pleased with their efforts and thrilled by their enthusiasm. The communication between them was genuine, and I could see through my observations that they understood what they were doing.

Performance-Based Assessment 1

Key Organizing Question: *Can a substance be a liquid and a solid?*

Performance Task I: Rachel Ray, the famous chef from the Food Network, needs your help. A recipe she wants to include in her new cookbook calls for cornstarch to be added into the mixture. This seemed easy enough to her but something strange happened. She accidentally spilled some water into the cornstarch—the new substance she created was interesting, but now she doesn't know how to explain its state of matter in her description. Help Rachel decide if cornstarch is a liquid or solid by conducting your own investigation. Is it possible for this new solution to both a liquid and a solid?—you decide!

Not only were the students able to clearly illustrate their understanding of the task at hand, but they were also able to explain why they responded the way they did.

Your teacher prepared a mixture of cornstarch and water in a resealable plastic baggie (60mL of cornstarch and approximately 30mL of water was placed in each bag).

- *Make a prediction. Is the new substance a liquid or a solid?* ("It could be both a liquid and a solid. It depends on how you look at it.")

Observe and feel the mixture in the bags. Answer the following questions:

- *What happens to the mixture when you squeeze the bag?* ("It feels hard like a solid.")
- *What happens to the mixture when you let go?* ("It looks more like a liquid. It started to flow in the bag.")
- *Do you think this mixture is a solid or a liquid? Why?* ("I know that liquids always take the shape of the container they are is in, so it might be a liquid, but it has properties of a solid, too.")
- *Describe two ways in which the mixture is like a liquid.* ("The mixture is like a liquid because it can flow and it can spread out.")
- *Describe two ways in which the mixture is like a solid.* ("It is like a solid because it is hard when you squeeze it and it won't move.")
- *If you wish, empty the contents of the bags into plastic trays. Feel the mixture and describe its properties. Share your observations.* ("It looked wet, but you don't get wet! But, when you pour it onto the plate, it flows. It kind of feels like pizza dough, but it looks like it's milk. I think it's cool how when you break it, it joins back together.")
- *What did you conclude? Is the new substance a liquid or a solid? Be sure to note the reasons why you gave the answer you did regarding whether or not you think the mixture is a liquid or a solid.* ("It is a combination of a liquid and a solid. It pours like a liquid, but when you press on it, it feels like a solid, hard.")

Performance Task II: Now it's your turn! Gather the following materials: 1 cup (250 mL) of cornstarch, 1 cup (250 mL) of water, ½ cup (125 mL) of cooking oil, and a resealable baggie. Experiment with adding portions of the cornstarch, water, and cooking oil into the baggie. Consider the following questions:

- *How has the texture of the new substance changed?* ("It is now slimy, squishy, and gooey.")
- *What happens when you squeeze the bag?* ("The materials didn't mix together. Instead, the oil stayed on top.")
- *What happens to the mixture when you let go?* ("When I let the mixture go, the cornstarch looked as though it was being absorbed into the cornstarch and water.")
- *Do you think this mixture is a solid or a liquid? Why?* ("This mixture is a liquid because of the oil that was added. Adding the oil into the mixture gave it more characteristics of a liquid than a solid. I tested it by dropping the bag on my desk and the substance flowed.")
- *Describe two ways in which the mixture is like a liquid.* ("It flowed. When I touched it, it felt wet.")
- *Describe two ways in which the mixture is like a solid.* ("When I squeezed the bag on the bottom, it felt sort of hard. I think the cornstarch and water were thicker than the oil.")

- *Can you think of an original way for this new substance to be used?* ("It could be used as glue because of its sticky texture.")

Performance-Based Assessment 2

Key Organizing Question: *Can salt change the temperature at which something freezes?*

Performance Task: Have you ever wondered why people sprinkle a salt substance on their sidewalks, driveways, etc., when it's icy? What is it about salt that can change solid ice to a liquid? Can something change the temperature at which something else freezes? Explore with salt and water mixtures to see if you can determine if salt will change the temperature at which water freezes. Good luck!

- *Make a prediction. Does salt change the rate at which water can freeze?* ("Yes, we throw salt on our sidewalks when it snows and it melts the ice.")

Keep in mind that water freezes at 0°C. Take one cup. Pour water to the fill line and add four spoonfuls of salt.

Take the other cup and pour water to the fill line. Do not add salt.

Place the cups in the freezer. Set a timer for 2 hours.

- *Reflect. Do you think the cups will freeze at the same time? Explain your reasoning.* ("The cups won't freeze at the same time because one has salt in it.")

After 2 hours, check the cups. Observe the substances in the cups. Consider the following questions:

- *Did the water freeze?* ("Yes, we put it in the freezer—we're making a big ice cube.")
- *Did the salt and water freeze?* ("No, it's kind of rough, it's not slippery like ice.")
- *What did you conclude? Does salt affect the rate at which water freezes? Why?* ("Salt doesn't let water freeze. Or, you could say that it could melt ice. Anyway, the way we did it, it didn't let the water freeze.")
- *What other purposes could salt be used for?* ("Small amounts of this substance could be added to ice-skating rinks to smooth out the rough spots. You don't always have to smooth out the whole rink, and this would conserve energy by not using the big Zamboni to do the job!")

That's Some Test

The results from the performance-based assessments were promising. Not only were the students able to clearly illustrate their understanding of the task at hand, but they were also able to explain *why* they responded the way they did—thus, providing me with insight I would not have uncovered had I gone with a traditional method of testing. Their scores, on the tasks and on their journal responses, were higher than *any* of the paper-and-pencil tests I had administered all year! I created a grading rubric to measure student work (Figure 1, p. 33). Students were able to see where their strengths and weakness were and discussion alerted them to the direction they may want to take on future performance-based assessments.

My assistant superintendent was right. I *was* pleasantly surprised, not only with my students' accomplishments, but with my own rejuvenated interest in testing, as well. A quote from one of my students—*Are you sure this is a test, Miss Flynn? This is fun!*—says it all. There's hope to overcome the testing frenzy—it comes in the form of performance-based assessments. ■

Connecting to the Standards

The article relates to the following *National Science Education Standards* (NRC 1996).

Assessment Standards

Standard B:

Achievement and opportunity to learn science must be assessed.

Standard C:

The technical quality of the data collected is well matched to the decisions and actions taken on the basis of their interpretation.

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Resources

Burke, K. 1994. *How to assess authentic learning.* Arlington Heights, IL: Skylight Training and Publishing.

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National Research Council (NRC). 1996. *National science education standards.* Washington, DC: National Academy Press.

NSTA Connection

Download blank worksheets of the performance-based assessments in this article at *www.nsta.org/sc0804*.