FEED UP, FEEDBACK, AND FEED FORWARD

How one teacher assesses her kindergarteners during a unit on conservation

By Douglas Fisher and Nancy Frey

Mention assessment and most people are likely to think about standardized tests and other formal methods for measuring what students know. But traditional paper-and-pencil tests inadequately describe what a child knows and still needs to learn because they come too late in the learning cycle. Children have a deep curiosity about the physical, biological, and social world, and they require an assessment system that fits with this science inquiry. In other words, they need a formative assessment system that feeds up, feeds back, and feeds forward. This assessment process, first described by Hattie and Timperley (2007), focuses on the ongoing information that is transmitted between teacher and student throughout the unit. Our experiences suggest that all three of these components are necessary for assessments to be of value, and on the plus side, none of them interfere with inquiry learning!

Feeding up establishes a substantive line of inquiry that compels learners to engage in investigation and inquire. It also forms the basis for the assessments that follow. Once students understand the purpose and begin to work, they receive feedback that is timely and scaffolds their understanding. Based on their responses, the teacher gains a sense of what learners know and do not know. These practices drive a feed forward system that informs the teacher about what needs to be taught, or what students need to experience, next. Hattie and Timperley (2007) described this as an “ideal learning environment or experience” that “occurs when both teachers and students seek answers to each of these questions” (p. 8). The dynamic nature of this inquiry-based assessment approach allows the teacher to make adjustments as students gain knowledge and skills and respond in a timely fashion when their learning stalls.

In this article, we describe how a kindergarten science teacher used this inquiry-based approach to assessment with her students during a unit on conservation of resources. She found that this approach to assessment allowed her to make adjustments in instruction and experiences as students needed them, rather than wait until the end of the unit. In addition, this formative assessment system complemented her inquiry approach and the information she collected about student understanding did not interrupt her students’ investigation.
Feed Up: The Purpose of Assessment

Kindergarten teacher Debra Randall wanted to introduce her students to the principles of conservation using an essential question that would invite investigation and experimentation. In preparation for this unit, the students had filled two clear glass jars with soil the previous month. The soil in one jar covered a used plastic straw from one of the children’s juice boxes, whereas the other covered an apple core from another child’s lunch. A month later, she introduced the essential question to her students: “Where does trash and garbage come from, and where does it go?”

The teacher (not students) should unearth the materials in front of students. Then place each item in a separate sealed plastic bag. This will prevent any exposure to potential microbes or fungi. Also have students wash their hands with soap and water once they are done viewing and handling the bag.

This provided the children with an overarching purpose for their unit of study. Each daily lesson included a statement of purpose that students used to guide their inquiry. For example, the students were told that, “the purpose of this lesson is for you to use your observational skills to describe what you’re finding out about what happened to the plastic straw and the apple. Each of you will draw what you’re seeing and talk about it with your team.” This purpose statement was an important and effective instructional routine to support her student’s learning (Hill and Flynn 2006). It also focused her formative assessment of the lesson because it made clear how and what she would assess.

Ms. Randall distributed clipboards with observation sheets attached and then invited several children at a time to observe the two items. As they studied the contents of the two jars, the teacher modeled how she posed questions to herself. “I wonder how these two things have changed,” she said, “and I’m thinking about what they looked like when we put them in the jars last month.” As students returned to their tables to draw and discuss, she made notes on the observation behaviors of each child, and wrote down some of their questions, as when Araceli asked, “Why did the colored stripe on the straw change?”

Once all of the children had an opportunity to view the jars, Ms. Randall visited each table to gather further information about their budding understanding of decomposition. The materials students had access to in this investigation all decompose. It is a matter of the length of time Summer 2011 27

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**Our Science Goals**

<table>
<thead>
<tr>
<th>Our Science Goals</th>
<th>I can do this by myself!</th>
<th>I am learning how to do this.</th>
<th>This is new for me.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Using math in science</strong></td>
<td>I can measure the amount of trash and garbage we generate and reduce it.</td>
<td>I know how much we generate, but I don’t know how to reduce it.</td>
<td>I don’t know how much trash and garbage we generate.</td>
</tr>
<tr>
<td><strong>Using science every day</strong></td>
<td>I can take care of our compost bin.</td>
<td>I can follow my teacher’s directions for taking care of the compost bin.</td>
<td>I haven’t used a compost bin before.</td>
</tr>
<tr>
<td><strong>Using science to make the world a better place</strong></td>
<td>I can sort trash and garbage for recycling and composting.</td>
<td>Most of the time I can sort trash and garbage correctly.</td>
<td>I don’t know how to do this yet.</td>
</tr>
<tr>
<td><strong>Using science to solve problems</strong></td>
<td>When there is a problem, I can use my science knowledge to solve it.</td>
<td>I am beginning to use what I know about science. Sometimes the teacher solves it for me.</td>
<td>The teacher solves most of my science problems.</td>
</tr>
<tr>
<td><strong>Communicating with others</strong></td>
<td>I can work with others to offer, ask for, accept, and politely decline help.</td>
<td>Sometimes this is hard for me to remember, but I am doing this more often now.</td>
<td>It is hard for me to work with others, and I like to work by myself.</td>
</tr>
</tbody>
</table>
Ms. Randall's feed-forward efforts.

1. Ms. Randall: How do you know if something can go in the compost?
2. Brianno: It has to be food.
3. Eric: Yeah, you gotta be able to eat it.
4. Ms. Randall: All food goes in the compost?
5. Brianno: Yeah, all the food. [looking around the room] Banana, sandwich, apple, watermelon, chips ...
7. Ms. Randall: I'm thinking about the kinds of foods listed on our poster. Remember the poster we made about food that can go in the compost?
8. Eric: Yeah, it's right there, look. [pointing to the wall]
9. Destini: Not meat, no way. The worms can't have that meat. And it will make it smell.
10. Ms. Randall: Right. I remember that, too. No meat for the compost because the worms can't eat it and it will just rot. And meat can attract rodents, which we really don't want, right? And what else? I'm seeing some things in your bin for composting that I'm not sure will work.
12. Eric: Apple, watermelon, bread with peanut butter, peach ...
13. Ms. Randall: Pause right there. What was that?
15. Ms. Randall: I thought you ate the peach.
17. Eric: Like the apple seed.
18. Ms. Randall: Take a look at the size chart next to the list of items for composting. What are you seeing?
19. Eric: It's too big! We can't cut that up to the right size because it's too hard, so that shouldn't go in. The apple seed is small so it can go in, but not that watermelon part.
20. Ms. Randall: It's called the rind. And you're exactly right. The peach pit, the seed from the peach, is too big and too hard for our worms. We can't put that in our compost. We can put the watermelon rind in, if we cut it up.

Several days later, Ms. Randall's students constructed a simple composting heap in the school garden, which was fenced in and used by multiple classes. Students also set up recycling bins in the classroom (see Internet Resources).

The teacher needs to inspect all student items for the compost heap to make sure they are appropriate and would decompose (i.e., food scraps, paper containers, no meat or plastic). Hands must always be washed with soap and water after working with compost materials. A few individuals may be sensitive to some of the organisms (e.g., mold) in compost. The compost pile should not be stirred or disturbed when individuals who are susceptible to inhalation of allergens are nearby. Check with the school nurse and inform parents of this activity prior to having students do it.

The students were going to investigate how much trash and garbage their class generates and find ways to recycle as much of it as possible. The teacher gave each team responsibilities for collecting, sorting, weighing, and charting their refuse. One team maintained the compost heap, another maintained the recycling bins, and so on. Ms. Randall provided the necessary materials, including earthworms and tools (such as shovels), as well as instructions for completing tasks safely (e.g., wear gloves when handling trash, properly handle and use tools). After the lunch scraps were gathered, sorted, and weighed, one group added the items to the compost.
Definitions

Feed up: Establishes a substantive line of inquiry that compels learners to engage in investigation and inquire and forms the basis for the assessments that follow.

Feedback: When students understand the purpose and begin to work, they receive feedback that is timely and scaffolds their understanding.

Feed Forward: A system that informs the teacher about what needs to be taught, or what students need to experience next.

compost heap and gently mixed it for the earthworms. The entire class observed the changes they saw each day and discussed it with their teacher, who chronicled their observations on chart paper.

Ms. Randall was interested in their content knowledge and the ways her students worked collaboratively. She collected observational data of her own about the way each team functioned using a narrative tool, with the following indicators: (1) Students are interacting with one another to build each other's knowledge. Outward indicators include body language and movement associated with meaningful conversations, and shared visual gaze on materials. (2) Students use accountable talk to persuade, provide evidence, ask questions of one another, and disagree without being disagreeable.

Her students know that she provides them with information about what they do well and what they still need to learn about working well together. Since the beginning of the school year, students worked on what Ms. Randall calls “the helping curriculum.” She believes that a key life skill for all of her students is to learn how to ask for help, offer help to others, accept help, and politely decline help (Sapon-Shevin 1998). When she noticed that the composting group was having difficulty accepting help from one another, wanting instead to do everything alone, she recognized that this needed to be addressed. She knew this lack of collaboration would be a barrier to their science learning, so she met with the children, using the rubric (Figure 1) as a way to ground the discussion.

“When you were adding the lunch leftovers to the composting pile yesterday, I saw that you were tussling over who would throw them in, who would stir, and who would add the water. Can you tell me about that?” Over the course of several minutes, it became clear that the group had not agreed on whether one person a day should do all the work, or whether all three of them should work together each day. As Ms. Randall reflected on their concerns, the students began to realize that the job was bigger than one person could handle, and would take too long. They agreed to try out the task together. “After you try it together tomorrow, let’s talk about it again to see what worked and what didn’t.” In this case, Ms. Randall used feedback to develop opportunities for her students to make changes. By ensuring timely and actionable feedback and follow-up, the children had a clear way to apply the feedback constructively.

Feed Forward: Where Do We Go Next?

An overlooked aspect of assessment is using the data collected to make instructional decisions. Assessments can be used as a tool for learning when teachers focus on the feed forward aspect and then guide students to additional learning experiences. As we have noted, it is not sufficient to simply provide students with feedback about their performance. Instead, we have to analyze the errors, misconceptions, and partial understandings that students have and plan next-step instruction to ensure that they gain a greater understanding. Feed-forward instruction does not mean that students are told the information they are missing, though, as that would violate the entire inquiry process. Rather, feed-forward instruction should involve additional experiences that help students clarify their understanding and can involve the teacher in questioning, prompting, and cueing learners. Unfortunately, when students make mistakes, their teachers can also err by re-assuming the cognitive responsibility in an effort to provide the missing information. Instead of directly explaining, teachers can guide students to greater understanding through the use of questions, prompts, and cues.

Making observations of fresh apples and a decomposing core (in bag).
Questions should allow the teacher to check for understanding. These brief questions should not simply elicit recall or knowledge-level information, but rather should allow the teacher to uncover misconceptions or errors. Elaboration questions, which require that students explain their thinking, are particularly helpful in checking for understanding. When errors or misconceptions are unearthed, teachers can use prompts or cues to guide the learning. Prompts encourage students to engage in cognitive or metacognitive work, such as when a teacher prompts a student for background knowledge or a problem-solving heuristic. For example, when Ms. Randall prompted a group of students by saying, “How is it that items get sorted?” she was asking them to reflect on what they have learned to correct an error they have made. In addition, cues refocus students on an information source they are missing. There are a number of cues, including verbal, visual, gestural, physical, and environmental that all do essentially the same thing—invite the student to notice something that may help resolve the error or misconception. For example, when Ms. Randall followed up by saying, “Take another look at the poster we made,” she was cueing students to notice the qualities that make an item recyclable. Further, this gives her insight into whether a concept needs to be retaught. Consider Ms. Randall’s feed-forward efforts when the students in one of the groups attempted to compost items that did not belong in the bin (Figure 2, p. 28).

A Sophisticated Model

Taken together, feed up, feedback, and feed forward provide teachers and learners with a system of assessment that is consistent with inquiry-based learning. This system relies on teachers making instructional decisions by guiding their learners to additional experiences. This requires attention to the content and procedural knowledge that students are learning, as well as the investigative skills necessary for scientific thought. These often defy simple paper-and-pencil tests and are therefore overlooked in traditional assessments. However, by drawing from a more sophisticated model of formative assessment that reflects the inquiry-based nature of science, both content and investigation are afforded the attention they deserve.

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References

Internet Resources
How to Make Classroom Compost Bins
www.ehow.com/how_5566061_make-classroom-compost-bins.html

Connecting to the Standards
This article relates to the following National Science Education Standards (NRC 1996):

Content Standards
Grades K–4
Standard A: Science as Inquiry
- Abilities necessary to do scientific inquiry
Standard C: Life Science
- Organisms and environments
