Young Students' Science Writing: Raising the Bar

by Paula Schachtel

When I began using science notebooks, I was a first-year teacher in a kindergarten classroom in an urban school. More than half of my twenty-five students were learning English as a second language. Few of the students had attended preschool and most did not know their letters or sounds at the beginning of the school year. I began with a simple belief that science notebooks are important and that my students needed to write in them following each lesson. It never occurred to me that they were too young to be able to make entries in their notebooks. But I also was not at all clear what those entries should be or how I should teach my students how to make them.

Meaningful Notebook Entries

Initially, I was primarily concerned with coming up with something for the students to write. If they were making an observation, then I knew the students needed to make a scientific illustration. Beyond that, I was not sure what to do. So, for most entries, I simply had students make statements about what they did in the science investigation. Many of the notebooks looked very similar, and most of the writing was shared writing that we did together and they copied into their notebooks rather than writing that students did independently.

About a year after I began using science notebooks, I looked at student notebook samples with other kindergarten teachers for the first time. One of the samples I shared was written after a lesson in which students get a type of wood (for example, cedar) and then are to find an identical sample hidden in the room. I had students copy and fill in the following sentence: "I found _____ [cedar] in the _____ [home center]." One of the teachers in the group asked what we knew about the student's thinking from the entry. I realized that I had not provided a writing frame that allowed students to think and show their thinking about the main concept in the lesson: types of wood have similar and different properties.

After this experience, I understood how important it is to focus not on what students have done but on what they are thinking as scientists. I also saw the importance of asking the right questions to prompt students to think scientifically. I began to use a focus question for each lesson to help keep the students—and just as important, myself—focused on the scientific thinking being developed in each investigation. The focus question also became my guide for the classroom discussions following an investigation.

The next time I taught that wood lesson, I used the focus question, "What properties do you look for when you match pieces of wood?" This helped me focus student writing on how they used properties of wood to determine whether two samples were a match. One student wrote in that notebook entry, "To match cedar I looked for the dark grain." From this entry, I knew that the student could identify a property of cedar, which involves both observational and thinking skills.

Increasing Independence

Focusing on scientific thinking and using a focus question were steps in the right direction. But I still found that I, as the teacher, was dictating—through modeled and shared writing—much of what went into the students' notebooks. Consequently, many of the notebook entries continued to look identical. Because many of the students in the class were just beginning to learn their letters and sounds, I initially was not sure that they would be able to do more independent forms of writing.

Soon I learned that my own expectations were holding the students back. For example, I was frustrated that when students were making illustrations, they often would just copy the class scientific illustration that I made during the class discussion. If I removed the class sample, some students would become frustrated and unsure about what to do. I realized that I was expecting students to know, without explicit instruction, how to show their thinking in illustrations. I was not providing appropriate scaffolding and modeling for how to communicate scientific thinking through illustrations. Once I realized this, I had to consider very specifically what type of thinking I wanted students to show through their illustrations and what specific skills they would need to be successful. I taught minilessons on techniques for making a detailed scientific illustration (for example, using a hand lens, drawing a dashed line to represent movement, making icons, and drawing "before and after" pictures to represent change). My kindergartners became much more independent and detailed in their entries, which, in turn, improved their observational and thinking skills. Students shifted from making drawings that were very similar to the class illustrations to communicating their own observations and scientific thinking through their own drawings and writing.

I also had to overcome my expectations about how the entries should look. Although I had taught my students to use the science word bank to find words to use in their notebook entries, and had helped my students develop strong phonemic spelling skills, I was not allowing them to fully implement these skills in their notebooks. I realized that as long as I focused on students' writing skills (handwriting, neatness, spelling, and other conventions), I was missing evidence of complex scientific thinking. By focusing on evidence of scientific thinking, scientific skills, and understanding of content, I found that students with less developed writing skills often had as sophisticated entries in terms of scientific thinking as their peers who had more developed writing skills. At the same time, teaching kindergartners to use resources in the classroom environment (for example, the science word bank, word families, and sight words) and strategies for spelling allowed all students to move well beyond fill-in-the-blank types of writing and successfully communicate their individual scientific ideas and thinking regardless of the developmental stage of writing.

To increase the students' independence, I also began to ask during the shared writing minilesson, "What is another way we could write about this?" This helped students see that there were many ways to write, gave them the freedom to choose the tools that made sense to them, and helped them write about what they wanted to say. I found that this increased students' motivation to write in their notebooks because they were writing about *their* important observations and discoveries rather than trying to fit their thinking into one model of writing. As the school year progressed, the students became more familiar with scientific vocabulary and would use it more and more in their notebook entries. For students who were struggling, the writing frames would assist in getting their thinking into writing. And by simply asking the students for other ways to write, I implicitly gave the students who

were ready the freedom and the tools to vary the writing frame to better fit what they wanted to communicate.

Giving Feedback

After several years, I felt that I was using the notebooks as a tool to help students develop their scientific thinking, and that with modeling and scaffolding, my young students were drawing and writing independently about their thinking. My next challenge was to provide individualized feedback and instruction to help all my students continue to progress in their writing development. At first, I struggled with giving feedback, and often my comments to students were very generic (for example, "I like how you used scientific words"). This type of feedback did not help them recognize strengths in their notebook entries, nor did it motivate them to try new things or go further in their future work.

This began to change when I shifted to talking about the scientific community as the audience for their notebook entries. I began to use comments such as, "Another scientist might wonder . . ." when giving feedback to students. At first it was awkward for me to frame my feedback in terms of what another scientist would notice and question in a notebook entry. But over time, this type of feedback helped students recognize what they had communicated clearly in their notebook entries, why that information was important, and what they needed to change or add. By helping my students recognize specifically what was strong in their notebook entries, they were able to recognize their strengths and build on them in future entries.

Giving this type of feedback also helped me encourage students to grow in their scientific thinking and writing. The writing minilesson allowed me to provide whole-group instruction, but giving feedback on a specific entry with one student allowed me to target instruction at that student's particular level or target a specific thinking and/or writing skill that she was working on. By discussing a question that another scientist might have after reading a notebook entry, I was able to help, in a nonjudgmental way, move their thinking and writing to a higher level. I did not provide feedback to each student after each notebook entry, but over the course of a week or two, I was able to give targeted and individualized feedback to all my students.

Working with More Advanced Students

After several years, I began teaching in another school with a very different population of students. The majority of them had attended several years of academic preschool before starting kindergarten and had parents who were college-educated. Most of the children knew their letters and sounds, and each year several children were already reading when they entered my kindergarten classroom in the fall.

At first, because the students began the year with more literacy skills than I had seen with my previous students, I made the mistake of providing too little scaffolding and modeling. However, I soon realized that despite their more developed literacy skills and greater prior knowledge about science, the students did not have experience writing about their scientific thinking. I found that I had to help them focus on writing and drawing about their observations. Many students tended to jump right into writing about their inferences or facts they had learned from their families, television programs, or other experiences, and forgot to use their direct observations as evidence for their thinking.

The difference between an observation and an inference became a frequent topic as we had group discussions about the investigations. When students would make inferences, such as, "The fish is hungry," or "The snail is tired," I would ask students what they had observed that made them think that. This helped students rephrase their inferences using evidence—"I think the fish is hungry *because* it swam quickly to the food and ate it," or, "I think the snail is tired *because* its foot is in the shell and it is not moving." Once students became comfortable using their observations as evidence for their inferences in their oral discussions, I soon saw them begin to write about their scientific thinking using the same structure. This made a significant impact on the quality of their scientific thinking and their expository writing.

For both populations of kindergartners, the benefits of using science notebooks were well worth the struggles and the time it took to teach students how to make entries in them. I saw my kindergartners develop thinking and writing skills that are an important foundation for their becoming critical thinkers as well as authors of intelligent expository text. Although I have always believed in providing appropriately rigorous curriculum and instruction for kindergartners, seeing the results of immersing them in inquiry-based science experiences and teaching them to think and write as scientists has raised the bar on even my expectations for them.