

On Writing in Science

By Sandra K. Abell

“My fourth graders write all the time in science. They record Purpose, Equipment, Procedures, and Results in their science notebooks for every activity. But lately they seem to resist writing. I’m thinking of dropping the writing—it just takes too much time. After all, they just need to learn science in science class.”

Why use writing in science?

Many teachers use writing in science as a recording tool (science notebooks) or to find out what students have learned (constructed response tests). Yet writing experts Judith Langer and Arthur Applebee (1987) tell us that writing to evaluate knowledge and skills is only one of several purposes for writing. According to their framework, writing in science classrooms can also: 1) draw on prior knowledge to prepare for new activities, 2) foster new learning, 3) consolidate and review ideas, and 4) reformulate and extend knowledge.

Can writing help students understand science better?

One of the most important reasons for using writing in science is to foster conceptual understanding. Mason and Boscolo (2000) studied Italian fourth-grade student writing in science. Students who engaged in writing to reflect, reason, and compare understood photosynthesis better than students who did not write to learn. Fellows (1994) found that urban middle school students who had more opportunities for writing explanations produced better logical arguments and changed their concepts about matter and molecules. Other studies have shown that students who write to explain their ideas learn science better than students who write only to record or summarize (Hand, Prain, and Yore 2001).

What supports do students need for science writing?

Many students find it easier to express their ideas through talking than writing. In a study by Warwick, Linfield, and Stephenson (1999), 11-year-olds were able to express clear understanding of fair testing and other experimental design ideas in interview settings, but those ideas were less apparent in students’ written work. However, teachers can help all students become better writers and better science learners by teaching them how to write scientifically. Warwick, Stephenson, and Webster (2003) found that the writing of fourth-grade students in England reflected high levels of understanding of ideas like variables and

fair testing after teachers provided a writing frame with prompts such as: “We are trying to find out... We made the test fair by....” (p. 176). Working with second-grade students in Wales, Patterson (2001) found that when

teachers provided explicit instruction in writing, students were able to express greater scientific understanding. For example, when teachers showed students how to use connectives (words like *for*, *to*, *when*, *because*) in their science writing, students moved from descriptions like “It has dots” to explanations like “It has got dots for bugs to eat” (p. 9). Thus, teaching writing techniques led students to express more thorough understanding.

How can teachers provide feedback on student science writing?

Owens (2001) found that elementary teachers are often frustrated about how to respond to science writing—Do we respond to the ideas or the writing? If students use the right words, does that mean they understand? How will my comments affect student learning?

How teachers respond to student writing will depend on the purpose of the writing. If writing is aimed at building science understanding, then teacher responses need to push for clarity in explanation and point out discrepancies in thinking. Teachers should not accept the right word as a substitute for conceptual understanding. For example, a student who writes, “Things float because of their density” might understand, or may just be making “noises that sound scientific” (Osborne and Freyberg 1985) without understanding that an object’s mass and volume are both



important considerations in sinking and floating. Teacher responses to science writing will help students become better writers and thinkers (Spandel and Stiggins 1990). In the density example, responses such as “What do you mean by density? Can you give an example? What about things that sink?” will help students move beyond vocabulary to conceptual understanding.

Should all students be expected to write in science?

All students can be involved in writing in science. For kindergarteners, science writing might include pictures and invented spelling. Even in second grade, students can improve their science thinking and writing when teachers provide writing supports such as concepts maps (Patterson 2001). But what about English language learners (ELLs) who struggle to communicate verbally, let alone in writing? Amaral, Garrison, and Klentschy (2002) conducted a longitudinal study of elementary science learning in a California district with 54% ELLs. The district instigated “kit- and inquiry-based science instruction that included the use of science notebooks” (p. 213) in grades K–6. According to research results, the longer ELLs participated in the program, the greater their science and writing achievement. By grade 6, ELL students who had been in the program for four years outperformed their English-proficient peers on a test of writing proficiency. The results of this study send a strong message that teachers should expect and support *all* students to succeed in science and writing.

What can teachers do to help students write to learn science?

Instead of merely writing *about* science, students need to engage in writing *to learn* science (Owens 2001). Writing to learn helps students build their knowledge through conjecture, explanation, comparison, and reformulation. Teachers can do the following to help students learn science better through writing:

- Ask students to write in science every day;
- Expect all students to be successful writers in science;
- Provide writing tasks that go beyond recording and summarizing;
- Include writing prompts that help students structure their writing; and
- Respond to writing with direct feedback about the science ideas.

In these ways, writing and thinking become essential components of the elementary science classroom.

Sandra K. Abell (AbellS@missouri.edu) is Curators' Professor of Science Education at the University of Missouri-Columbia (MU) where she directs the MU Science Education Center. She taught elementary science in Iowa, Iceland, and New Mexico before becoming a science teacher educator and science education researcher.

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