

Science Writing: A Tool for Learning Science and Developing Language

This paper was written as a component of the “Educators Guide for Inquiry-based Science and English Language Development,” a web resource created by the Institute for Inquiry® (IFI). It illuminates the classroom practice of science writing as an element in IFI’s framework for supporting students’ science learning and English language development. For more about this framework, visit exploratorium.edu/ifi/inquiry-and-eld/educators-guide.

Science writing is a particular type of classroom writing that is integrated into inquiry-based investigations in order to further students’ understanding of science. It often takes the form of notebook entries, as well as classroom posters, charts and diagrams.

Science writing helps students analyze and clarify their thinking, synthesize their ideas, and communicate them with others. It accompanies and records the thinking that occurs when students are engaged in the science practices that take place during an investigation, such as asking questions, planning and carrying out investigations, analyzing and interpreting data, and constructing explanations. It creates a record that can be returned to, responded to, and revised. Science writing can be shared with others, become part of the environmental print in the classroom (through posters, pictures, word walls, etc.), or provide a venue for written conversations between teacher and student. A piece of writing can be a repository for emerging ideas (a silent partner in an investigation) or result in a final product for sharing knowledge.

Science writing supports the construction of new scientific understanding because it gives students the opportunity to articulate their thinking as they engage in the science practices during an investigation. The fact that the writing takes place in the context of hands-on science means that students can draw from direct experiences that are interesting, meaningful, and shared.

“writing in science is not only for communicating with others; it is also a tool for learning that supports scientists and students alike in clarifying thinking, synthesizing ideas, and coming to conclusions.”

Karen Worth et al., *The Essentials of Science and Literacy*, Heinemann, ©2009

Language development is also supported by science writing. This mode of language use provides students with many opportunities to express and communicate their thinking. Science writing involves students in a metacognitive activity—they must consider the words they will use to communicate their thinking, reflecting and clarifying as they go. This process of reflection and clarification can lead students to develop their language as they refine their scientific thinking.

In addition to developing language by using it to exchange meaningful ideas, science writing also supports language development by creating artifacts that can be revisited at a later time to refine how one's ideas are expressed. This is especially helpful for English language learners (ELLs). In revisiting a piece of writing, the written piece itself becomes a platform for further reading, talking, and writing. Science writing can also include drawing because it can be used to communicate students' ideas and understanding. Many ELLs can draw their ideas before they can write them, making drawing an emergent form of writing.

Science writing can often be difficult, even for native English speakers. There are more skills that need to be in place for students to communicate in writing than they need to communicate orally. While it is not necessary for spelling, punctuation, or handwriting to be perfect for science writing to be effective, some degree of familiarity with these conventions is necessary in order for students to effectively capture their ideas in print.

"The student should record observations, thoughts, conclusions, questions, even whimsy that comes to mind, for discussion with others and later use. The record created in this way will serve the student well in organizing his or her thoughts. The notebook need not be beautiful, but a rule is that from it, after some length of time, the writer can reconstruct what was done, how it was done and what was found out. "

Jerome Pine, "The Science Notebook."
Unpublished Paper, 1996

There are also many language demands involved in writing (i.e., the language needed to express one's ideas and understand those of others) that need to be supported, especially for ELLs. A number of instructional practices and scaffolds can increase the likelihood that students can produce writing that will help them develop and effectively communicate their thinking.

Effective science writing is much more likely to occur when:

- Students have had interesting experiences and investigations to write about
- Teachers use prompts that clearly relate a writing task to a particular science phenomenon or experience
- Teachers model the kinds of thinking and writing they want to encourage their students to produce (for example, demonstrating a shared notebook entry in front of the class)
- Students are encouraged to use everyday language to express their ideas, and concentrate on communicating ideas clearly, even if spelling and grammar aren't perfect
- Students have a chance to talk before they write (if students can say something, they will have an easier time writing it)
- Students are strategically paired or grouped to help each other write, and prepare to write, by talking
- Language-rich environmental print (posters, word banks, charts, pictures) is an abundant resource in the classroom

- Early writers are encouraged to express their thinking through pictures as well as words—drawing can be an effective practice to combine with writing
- Students are given constructive feedback on their writing that pushes them to expand and clarify their thinking

Even with these conditions in place, it takes time for students to develop confidence and fluidity in their writing. Writing becomes an integral tool for science instruction once students have grown accustomed to using it in connection with their investigations, internalized a number of science-writing entry types, and gained experience referring back to their own writing to develop their thinking. As writing becomes a more regular feature of classroom culture, students grow less hesitant to write—especially when they recognize that they do not need perfect grammar and spelling in order to express and develop their thinking. A teacher can encourage this by responding to the science ideas in students’ writing rather than correcting spelling and grammatical errors.

Over time, students find a genuine use for the specific vocabulary associated with the phenomena they are exploring because of the clarity and precision it can lend to the expression of their ideas. This specific language may or may not have been a part of their everyday language. In certain cases, teachers will want students to produce more formal pieces of writing—such as final reports or poster presentations—where grammar and spelling are attended to. In these cases, student’s grammar and spelling will need explicit support from the teacher.

While science writing can improve students’ writing in general, its main benefit to language development is not in practicing writing in and of itself. Its primary role is to support learning and the communication of science ideas. This gives writing a meaningful context, and it is through this role that it can best support the development of language.

There is a strong reciprocal relationship between science writing and science talk. Talking can be a precursor to writing, and writing can be a precursor to talking. For instance, students can have a science talk before writing so they can listen to others and rehearse their own language and ideas before committing them to print. This practice can be especially beneficial for ELLs whose speaking skills are often more developed than their writing skills. In turn, writing can help students collect their thoughts without inhibitions before speaking. And a piece of science writing, such as an entry in a science notebook or on a posted word bank,

“in the classroom [science writing and science talk] are inextricably linked. Small- and whole-group discussions are often rehearsals for writing conclusions and reports, and quick-writes before a discussion can start ideas flowing. Discussion pushes students to clarify their ideas before they write their conclusions or write a more formal piece about their science experiences.”

Karen Worth et al., *The Essentials of Science and Literacy*, Heinemann, ©2009

can be a resource for students to refer to during a science talk. The combination of science talk and science writing supports the learning of science ideas and, in the process, helps students develop the language to express these ideas.

In the Institute for Inquiry’s online resource, “Educators Guide for Inquiry and English Language Development” (available at exploratorium.edu/ifi/eld-and-science/educators-guide), annotated videos show two teachers using science writing in their classrooms, often in different ways. One set of videos focuses on students doing an investigation on snails; the other focuses on students doing an investigation on magnets.

In the “Snail Investigation” videos, notice how the teacher supports science writing by having students keep their science notebooks open and ready to record their thinking during their investigation. Additionally, students have dedicated time to record thinking afterwards and review their writing before science talks. Students’ notebooks also remain available to them for reference during science talks.

In the “Magnet Investigation” videos, notice how the teacher supports science writing by having students refer to their science notebooks for procedural information, such as recorded investigation plans. She also discusses and models writing-entry types, such as claims and evidence. Students have oral practice before writing, are organized into collaborative groups so they can support each other while writing, have a lot of environmental print in the classroom (posters and charts showing useful words and ideas), and enjoy a culture where they regularly share and comment on their writing with each other.

Additional resources for information on science writing can be found in the Institute for Inquiry Resource Library, available at exploratorium.edu/ifi/resourcelibrary.

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