

# Writing to Learn in the Content Areas

It's about *process* more than it is about *product*.

Karen Bledsoe — karenbledsoe@comcast.net, <http://www.gkbledsoe.com>

Since my background is in science, much of what I'll say here pertains to science education.

Cognitive psychology supports the concept of writing to learn. Within the realm of science and math instruction, the assumption seems to be that once students understand concepts and can define vocabulary terms, they can use the language of science fluently. In life, however, conceptual understanding and use of language build on one another. This cognitive understanding of the relationship between language and learning is the underlying foundation of writing to learn within the disciplines.

## The theoretical part:

Why writing? For most cognitive theorists (including Piaget and Vygotsky), the shift from concrete/situational thinking to abstract/categorical thinking involves the use of written language — reading, writing, or both. As children learn to use language, a word such as “dog” may stand for one particular dog — a simple abstraction. Later, the word stands for all dogs — a more complex abstraction, where a word stands not for a specific instance of one dog or several dogs, but for the broader concept of “dog.” Thus the development of language and concepts are intertwined from the start. There is little reason to imagine that this process does not continue throughout life.

Writing supports the development of formal operational thinking. Forcing global, web-like, or imagistic knowledge into the typically (but not strictly) linear form of writing demands, whether implicitly or explicitly, analysis of knowledge, organization of ideas, and synthesis into a new product. The act of writing forces the writer into a new familiarity with knowledge which can generate new understandings through new links between concepts.

## Writing and science

Writing and science go hand-in-hand. The “double-entry” or “dialectical” notebooks used in literature classes are the direct descendant of detailed lab notebooks. Learning logs descend from the empirical habits of collecting and summarizing information, such as when a

scientist does a literature search (Darwin’s notebooks are a classic example, and are often read as literature).

Communication, typically in the form of journal articles, is absolutely essential the progress of science.

However, what students see of scientific writing is usually the “empiricist repertoire,” that is, the finished journal article or the collection of facts in the text. What they do not often see is the “contingent repertoire,” the informal writing of science that goes on in the field, at the lab bench, at conferences, and anywhere scientists

gather and work. This gives students a distorted view of what science is, how scientists work, and how science relates to writing and the creative process.

## What Writing to Learn is *not*:

Writing to Learn is not “grammar across the curriculum.” It is not

“making spelling count in science.” It is not “formatting papers in the content areas.” As important as grammar, spelling and format are, they are not the focus of Writing to Learn.

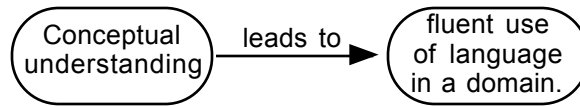
Nor is Writing to Learn simply throwing a poetry lesson in the middle of a biology unit that is otherwise untouched by writing, though articles and manuals on writing across the curriculum may leave you with that idea. An activity such as “Write a Haiku about your favorite animal” is extremely unlikely to help children learn about animals, as students are most likely to begin and end with the knowledge they have already, and it trivializes the ancient, honorable, and difficult art of Haiku.

## What Writing to Learn is:

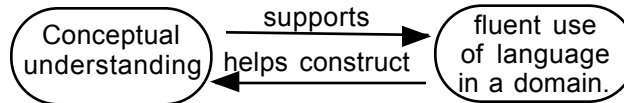
The purpose of Writing to Learn is to increase *learning*. Improvement of writing skills is not the primary goal, though it may be one outcome. Writing to Learn moves learning from being a spectator sport to active participation through the use of frequent writing, mostly informal.

Typically, the informal writing used in Writing to Learn is not graded for content. If collected, the teacher will often write comments on the papers to provoke thought. Writing-to-learn exercises often serve as quick

The typical assumption in science and math class:



How cognitive psychology views the relationship between language and learning:



assessments of student understanding, as well as helping students to clarify their own ideas.

For Writing to Learn to work, however, an environment of trust must be established. It is important for the teacher to write and share his or her writing with the class so that students recognize writing as something more than just a class exercise.

Writing allows all students to participate in class discussions, not just the vocal few. Many students, too shy to speak in class, seize up when asked to answer a question on the spot. A writing exercise allows these students to organize their thoughts so that they can reflect first and be ready to discuss a concept.

### Examples of Writing to Learn tasks:

- *Focused free writing*: to “cast a net of inquiry,” to explore a term, issue, question, or problem.
- *Attitudinal writing*: expectations, experiences, everything the students bring to the topic. What difficulties are you having? What are your successes?
- *Reflective and probative writing*: to begin or end a class, or to re-focus a discussion.
- *Metacognitive writing*: to observe oneself reading, thinking, taking an exam, writing a paper. Recording one’s own learning behavior to become more autonomous. “How is this problem like or unlike others you have seen? How will you try to solve it?”
- *Explaining errors*: on tests and homework.
- *Questioning*: writing during reading, homework, or in class, to pinpoint doubts or confusion.
- *“Think-Pair-Share:”* given a question or a problem, students think about it first and write down their thoughts. They pair with another student and share what they have written, and may write more about their shared viewpoint. The teacher then calls on pairs of students to share their thoughts with the class.
- *Illuminating prior knowledge*: students are given terms such as point, line, surface, energy, theory, etc. and asked to define them or write what they know about them. This is particularly useful in units where scientific or mathematical terms also have everyday meanings that can confuse and mislead students. After learning the mathematical or scientific definitions, students write about the differences.
- *Defining*: using personal definitions or personally-created metaphors instead of terms from the book. Also useful as a check for understanding.
- *Creating problems*: students design their own problems for others to solve.
- *Writing to read*: use of dialectical notebooks to record what authors said on one side and respond to it on the other side.
- *Learning logs*: recording information from many sources for later synthesis.

- *Micro-themes*: “one minutes summaries” where students summarize a concept or a main theme of class. Useful as a quick assessment.
- *Paired problem solving*: in pairs, students work aloud and on paper. By sharing their thinking, students can gain valuable insight into their own understanding.
- *Explanations*: students can record how they solved a problem so that other students can learn from them. Students can also write about errors they encountered and how to avoid them, which reinforces the process of understanding.
- *Reports*: somewhat overused, and requiring guidance throughout the process (a surprisingly small number of students, even at the college level, really understand how to write a good report without guidance), reports can lead students into topics of their own interest.
- *Essays*: students write about terms they normally take for granted, such as “What does it mean to ‘solve’ an equation?” or, “What does the ‘equals’ sign mean?” In science, essays such as, “What is the difference between heat and temperature?” or “What is energy?” or “What is the relationship between law and theory?” can reveal common misconceptions.
- *Write a book*: students contribute to a book on the topic of the class, beginning with creating the outline. Students must work as a team, divide the work, edit one another’s work.
- *Note-taking*: a skill we take for granted and expect students to have, though few do. Note-taking can encourage active participation, especially if students are writing down questions, points of confusion, or quick summaries along the way.
- *Peer critiquing*: When peers are the first audience for an essay or lab report, the writer is allowed some room for exploration. Peer feedback tells the writer whether or not the writing is comprehensible. The reviewer also sees a different model which the reviewer can learn from.
- *Real-world links*: Reading a lab report can leave the reader with a feeling of “so what?” In seeking and writing about real-world connections for the lab activity, students have the opportunity to construct deeper meaning for what they have done in lab.

### Sources

- Connolly, P. & Vilardi, T., eds. (1989). *Writing to Learn in Math and Science*. New York: Teacher’s College Press.
- Countryman, J. (1992). *Writing to Learn Mathematics: Strategies that Work*. Portsmouth, NH: Heinemann.
- Meir, J. & Rishel, T. (1998). *Writing in the Teaching and Learning of Mathematics*. Washington, D.C.: The Mathematical Association of America.