



Good Writing Assignments = Good Thinking: A Proven WID Philosophy¹

Roland Stout

The University of North Carolina at Pembroke

In his remarks about the future of WAC at the conclusion of the Writing Across the Curriculum 3rd National Conference, David Russell observed that WAC has historically been about writing to learn. He sees WAC's future as "writing to learn to do." This is exactly the nature of the Writing In the Discipline (WID) philosophy I have developed over the past decade. This philosophy allows me to easily construct questions that ask students to write in order to learn how to think like a chemist, that is, to learn to do chemistry.

Nothing about my philosophy of writing assignments limits its use to chemistry. It would work in any discipline helping students learn how to focus their thinking along the lines of that discipline. That is the spirit in which I present these models, appropriate, I believe, for any discipline. The examples presented below are drawn from the chemistry courses I teach.

Some years ago I was a member of a Task Force charged to develop a WAC program at a different institution. The short version is that the effort failed for a variety of reasons, one being the broadly based skepticism of the faculty. Their comments are probably all too familiar to many of you: "My teaching load is already too high; I don't have time to teach writing too," "I'm not trained as a writing teacher," or "How can I use writing to teach . . . (insert their discipline here)."

I struck out on my own, taking what I had learned about WAC. This included the long standing premise that writing is a form of thinking. A nice concept, but rather vague, I thought, and of little practical use in designing writing assignments. After a few years I had developed or borrowed several writing assignments that worked for me in teaching chemistry. When again prompted to think in a WAC-y way, I discovered that all of my writing assignments asked students to think carefully about something and to describe to me their thoughts. The light dawned. I was not giving writing assignments; I was really giving thinking assignments.

The vague concept was really not so vague at all. It was just a matter of learning how to apply it.

WID Philosophy

My WID philosophy is quite simple and drawn directly from the premise that writing is a form of thinking. I no longer think of my writing assignments as writing assignments, but rather as *thinking* assignments. I decide what thought process, concept or factual material I would like my students to understand and then devise a writing assignment focusing specifically on what I want them to think about. The more focussed the assignment the better. Some of my assignments are sharply focused on a single idea. For example, “In . . . the key step is . . . Explain why.” It is my experience that thinking about writing assignments in this way allows me to create far better assignments much more quickly than I had in years past.

While assignments based on this philosophy work well to teach chemistry, do they also work to teach writing? Not necessarily, but they can if structured appropriately. In order to write better it is necessary to think critically about your writing. One way to accomplish this with students is to have (force?) them to rewrite their work, not merely revise it. If they take it seriously, this almost always causes students to sharpen their writing. There is something circular occurring here. If writing is a form of thinking, and if students write better, they think better too. Better writing requires better thinking which generates deeper understanding—what I really wanted in the first place.

My course syllabi tell students at the beginning of my courses that I expect clear, concise writing and will help them learn how to write better if they will put in the effort, but that I can’t learn it for them. I use two basic tools to teach writing. The first is that even though I’m not trained as a writing teacher, I *can* recognize poor writing, awkward phrasing, improper grammar, illogical word choices and the like when I see them. Being ill-equipped to teach writing, I use my second tool, referring students to our writing center for more expert help than I can give them. To make the referral stick, I do not accept a revised paper until I have the confirmation from the writing center that the student was there. I also expect a higher standard of writing on a revised paper than on the original. In fall term classes with mostly new freshmen, I will often refer every student to the writing center, after warning the writing center to expect an influx, to make sure the students know where it is and how it can help them.

Proven Writing Assignments

Space prevents me from giving many detailed assignments here. I will present the basic outline of four types of assignments, give a few examples, and allude to others. If you want further information on any of these, feel free to contact me directly.

A bit of my teaching philosophy is in order here. I have two primary objectives in any course. The first is to teach chemistry, the second to ground that chemistry firmly in students' experiences and in our culture and society.

The Issue Paper

For a number of years I have assigned a term paper centered not on a topic but on an issue related to the course. The assignment is to give a balanced discussion of all the opinions (political, moral, ethical, economic, medical, etc.) on that issue, and then to state and defend (as if to a person of the opposing view) their own opinions. The over-all goal is to develop an informed opinion. The assignment is in a process writing framework with an outline and one or two drafts required, all peer reviewed by two other students. In the last peer review, I ask the reviewer to play the role of an opposing opinion and press the author for a rational defense of their opinion. We then spend some time discussing the sometimes vocal debate that ensues. One important question I want students to consider is whether there is a single right answer or valid opinion. I propose that they may need to be able to agree to disagree while remaining respectful of the other's opinion.

This assignment works extremely well, causing students to think deeply and critically about the relationships between the chemistry we are studying and issues that often swirl around its technological applications. Numerous students have told me that it has caused them, some for the first time, to recognize the distinction between an informed opinion and one adopted from another without much thought.

Two-Part Writing Assignments with a Twist

I have a number of two-part writing assignments. The first may be an essay answer on homework or an exam, or may be a short paper. Then I twist the assignment, forcing the students to rewrite (rather than merely revise), taking the writing to a higher level. A number of scenarios will get the process started: A letter to grandma, friend, or middle school student they are the mentoring, an essay question on an exam, a brief (1-3 page) paper, and others.

One such assignment begins either in homework or on an exam with an essay question asking students to write a letter explaining a concept to another person with far less background knowledge. In other words, they must explain a complex concept in clear, simple language, a task requiring considerable understanding to do well.

I then inform them that their letter was shown to someone (an uncle perhaps) who works for an encyclopedia company. You explained the concept so well, I tell them, that they want you to write an entry for their next CD encyclopedia. It should be presented with complete background (some students will have to add more supporting background) information. We usually discuss what this might be in class. Students rewrite or expand as necessary and submit their entries to the encyclopedia company. The review comes back: "It's too long. Don't cut any of the necessary background, content, or explanation, but trim your encyclopedia entry to about half its original length. Can you explain the concept clearly with fewer words?" In effect, students are being asked to try to develop a clear understanding of the concept that they can present cleanly and concisely. The second version is usually far better than the first. The best encyclopedia entries are "published" to the class.

In a sense this is actually a three-part writing assignment. As I think of it, and as it seems to function, the first two parts are actually sub-parts of the first portion of the assignment. Having to cut the entry to half its length represents the second step in which students are forced to critically evaluate what they have written and consider how they can express their ideas clearly and succinctly.

Another two-step assignment begins with the railroad line just south of our building. Many railroad tank cars are printed with the name of the substance the car contains. Students pick one, go to the library, and find something about it. In 2-3 pages, they tell me about it, where (chemically) it comes from, and what it may be used for. In the second step I ask them to write a short story with this substance as the main character. Where does it come from, where is it going and what will it do when it gets there? I ask them to consider this substance's journey both literally and figuratively, as well as be creative.

As you can see, the second step of these assignments has students rewrite, often in a different style or voice, which forces them to rethink what they want to say and sharpens and focuses the resulting product. I find that by the third or fourth such assignment in a term, my students are writing better at the beginning of an assignment, because they know I expect it, and they generally write more clearly on almost every assignment. There are essentially an infinite number of potential scenarios for two-part writing assignment as described here. The only limit is your imagination.

Writing in Bloom's Taxonomy

Bloom's taxonomy of cognitive educational objectives provides a useful way to construct questions to determine how thoroughly a student understands a concept (Bloom 201). The taxonomy is a 6-level, hierarchical set of education objectives or thinking skills.² Rosenthal (996) has published a similar set of skills, based on the work of Kiniry and Strenski (191), as a hierarchical set of expository writing tasks. The striking similarity of Bloom's thinking and Rosenthal's writing skills further suggests the intimate relationship between writing and thinking.

I often construct a series of homework or exam questions based on the same material but requiring successively higher thinking skills. It is not necessary to hit all six, but at the college level the questions should cover both lower and higher level thinking skills. Writing good questions that probe a specific cognitive level requires careful thought and practice. A complete set of learning objectives helps.

The first example comes from freshman chemistry and has three parts. The first uses level 1 and 2 skills, the second level 3 skills and the last level 5 skills. The last part involves two opposing influences. The key is to recognize which is more significant and why.

A. List four factors that affect the rate of a chemical reaction and explain briefly how each functions.

B. For the two cases described below, determine whether the chemical reaction would speed up or slow down and explain why.

C. Suppose for the same reaction the CaCO_3 was crushed to many small particles and the acid concentration was cut in half. Would the reaction speed up or slow down? Explain your reasoning.

The next question is taken from a take home final examination for a course in chemical instrumentation, a senior level course. It has three specific questions. The first is worded as a level 1 question, but really requires understanding of the concepts, a level 2 skill. The second question requires thinking skills from levels 3 and 4. The results of the second question are ambiguous, leading to a third question requiring both level 4 and 6 skills. The questions on this exam were based on the (fictitious) analytical company for which the student works.

H. I. Analytical needs to purchase a new visible spectrophotometer. You have been asked to make a recommendation to the boss. You ask your colleagues how

they are using the current instrument and what future uses they anticipate.

[A set of comments from several persons on the current and planned use of this instrument and its potential future use are given, along with comments from the boss regarding possible future expansion and budget matters.]

A. Develop a list of instrument specification criteria needed to meet the requirements you have been given.

B. Attached you will find a copy of the specifications for a number of different instruments. Determine whether and to what extent each of these meets the criteria developed in A.

C. Select the instrument(s) best suited to the company's needs and prepare and justify a recommendation for your boss on which to purchase.

Short Writings

I use a number of short writing assignments combined with another type of problem in much the same way as Yakali has shown works in chemistry and Mower in algebra in their presentations at the recent WAC conference. Typically these ask students to explain how they approached or solved the accompanying problem. For example, I might ask my freshman chemistry class to solve the following limiting reagent problem:

Determine the mass of phosphoric acid that can be produced by the reaction of 1.00 metric ton of phosphate rock ($\text{Ca}_3(\text{PO}_4)_2$) and one metric ton of sulfuric acid in the commercial process below. Explain briefly the step-by-step procedure you followed in solving this problem.

(Chemical reaction omitted)

In many cases asking for a step-by-step process reminds students to think of the problem in a stepwise way rather than being overwhelmed by the entire problem. Thinking about how they solve a problem also helps them understand better how to solve it, rather than just memorizing and following a "cookbook" procedure. Sometimes I merely ask for an explanation of how to solve the problem and not the solution itself.

Another short writing assignment I have found useful is to have students begin to devise a procedure to solve ... (some particular type of problem). I usually use this in a cooperative learning setting, not giving groups enough time to work out an entire procedure but enough to begin

thinking about it. We then pool approaches and devise a complete process.

Cooperative learning situations afford a number of writing opportunities, too many to describe here. For a good introduction to the theory and practice of cooperative learning at the college level see Johnson et al.

One more cooperative learning assignment that I find useful is based on structured controversies (Smith 309). It works well for an issue-laden topic. I last used it on the spur of the moment when several students had questions about a hot, local environmental issue. It was a digression from freshman chemistry, but was nevertheless one of the most worthwhile assignments I used that term. I was able to draw the issue back into chemistry at several subsequent points and discuss the relevant chemistry involved. The assignment takes all or most of a period and begins when I give each student in a group a different position on an issue.

A. Individually, write several short (1-3 sentence) reasons for supporting this position.

B. You are all members of the Anytown City Council. You must come to a consensus on this issue at tonight's meeting, to present to the County Commissioners next week.

In your coop. group, consider all the members' positions and come to a consensus. Do not vote; persuade. Turn in each student's position statements, your group consensus, and the justification for it that you will present to the County Commissioners.

In a variation of this assignment you could have different groups develop positions on opposing sides of an issue and then stage a debate.

Conclusion

I have found that using the philosophy of ~~writing~~ thinking assignments presented here, I am able to use writing as a teaching tool alongside the other, more typical teaching tools of chemistry. It bears repeating that though I use it in chemistry, nothing about this philosophy limits it to chemistry. I believe that if you can clearly articulate what it is that you want students to think about, it is possible to create a tightly focused thinking assignment by asking students to write about that subject. Furthermore, creating assignments that cause students to think critically about what they have written causes them to think critically about their own thinking as well, generally resulting in clearer thinking and richer understanding.

To those of you from disciplines where writing has long been the primary tool for thinking and communicating, this is probably old news. But for persons in disciplines where the primary thinking tools are symbols, equations, graphs, pictures, or mathematics, it may offer a new way to translate thinking done in those more abstract dimensions into the written word, and more importantly, show our students how to make this translation too, improving their thinking and learning in the process.

Works Cited

- Bloom, B.S., Ed. *Taxonomy of Educational Objectives. Handbook 1. Cognitive Domain*. New York: David McKay, 1956.
- Johnson, D. W., Johnson, R. T., and Smith, K. A. *Active Learning: Cooperation in the College Classroom*. Edina, MN: Interaction Press, 1991.
- Kiniry, M. and Strenski, E. "Sequencing Expository Writing: A Recursive Process" *College Composition and Communication* 36 (1985): 191.
- Mower, Pat. "Fat Men in Pink Leotards and Other Student Writings," Writing Across the Curriculum, 3rd National Conference, Charleston, S.C., Feb. 6-8, 1997. See also: Mower, Pat, "Fat Men in Pink Leotards or Students Writing To Learn Algebra." *Primus* VI (1996): 308.
- Rosenthal, L.C. "Writing Across the Curriculum: Chemistry Lab Reports." *J. Chem. Educ.* 64 (1987): 996.
- Russell, David R. "WAC on the Boundaries: Past Practices, Future Promises," Writing Across the Curriculum, 3rd National Conference, Charleston, S.C., Feb. 6-8, 1997.
- Smith, K. A. "Structured Controversies." *Engineering Education* 74 (1984): 309.
- Yakali, Emel. "Writings in Chemistry," Writing Across the Curriculum, 3rd National Conference, Charleston, S.C., Feb. 6-8, 1997.

Notes

¹ Presented in part at the Writing Across the Curriculum, 3rd National Conference, Charleston, S.C., Feb. 6-8, 1997.

² The six levels in the cognitive domain are shown below, given with several learning objectives appropriate for each level. Levels 4-6 are generally considered higher level thinking skills.

1. Knowledge - recognize or recall information
List, recite

2. Comprehension - understand the meaning of information
Explain, paraphrase
3. Application - use the information appropriately
Calculate, solve, determine, apply
4. Analysis - break information into component parts and see relationships
Compare, contrast, classify, categorize, model
5. Synthesis - put components back together to form new products or ideas
Create, invent, predict, design, imagine, improve, propose
6. Evaluation - judge the worth of an idea, theory, opinion, etc., based on criteria
Judge, select, decide, critique, justify, verify, debate, recommend