Writing Fellows 2019 – Barbara Walden (Physics)

My initial goal in being part of the Writing Fellows program was to develop writing strategies for our department's Writing II course specifically to help our students whose native language is not English. Over the course of the program my emphasis has broadened to include the more general writing difficulties I noticed among almost all of our students in this course, difficulties which make me suspect that students do not know how to use writing to work out scientific ideas. My main takeaway from the Writing Fellows program has been: think of writing as a conversation.

The course I'm focusing on is Phys-320 *Modern Physical Measurements*, which I taught last spring for the first time in many years. I have found it useful to think of this as a course in "physics literacy," with a goal of not only to help students become familiar with basic pieces of electronic laboratory instrumentation, but also to gain the ability to communicate with other scientists about scientific work in general and their own work in particular. Students in this course perform experiments in "modern" physics, some of which are both technically difficult and conceptually challenging, and analyze their data using sophisticated methods of error analysis. They work on the experiments with one or two lab partners, rotating through a set of four 2½-week experiments over the course of the semester, with different lab groups for each experiment. For each of these experiments students individually write up their work in the form of a professional paper, submitting first a draft and then a final version.

I have found that in their writing, students have difficulty with organization, content, tone, and grammar. In particular:

- Students are used to writing "lab reports," which to them are stream of consciousness records of their lab work, with topics written about in the time order they encountered them in lab.

  A lab report is very different from a *professional paper*, in which ideas are organized by topic into distinct abstract / introduction / experiment / data / analysis sections, rather than by time. Students have a great deal of trouble organizing information correctly, and tend to mix it all together.

- Some student papers become effectively "equipment manuals" rather than professional papers, with an overwhelming focus on a step-by-step record *what* they did rather than why, or what they found and why it was meaningful. So rather than

simply saying something like "an oscilloscope was used to record the response signal," there would be a discussion in excruciating detail about which connections should be made for the very specific pieces of equipment they were using.

- Students tend to write in an artificial "important science" voice.

- There are serious grammatical issues for some, especially those for whom English is not their native language.

- Many students don't know what they are "supposed" to find most interesting, so their papers lack focus and they have difficulty writing an abstract.

Some of these difficulties may result from the contrast between the way in which students do the experiments and the way in which they then write about the experiments. The experiments themselves are carried out collaboratively. But once the data collection is done, do students then stop talking to one another, stop having conversations about what they're doing, what they're finding, and why, when they start writing? I suspect this is true. Even within groups who have the same data, the conclusions are not always the same!

For my next iteration of this course (Spring 2020), I want to focus on ways to get students to collaborate more in the writing process – with their lab partner, with the class as a whole, and with me. In effect, I want them to think of the writing piece as an extension of the discussions they had with me and with one another while figuring out how to do the experiment. Here are some of my preliminary ideas:

- First, from the 2018 version of this course, something that was effective and something that was not: In class I had students look at a purposefully-designed "bad graph," and tossed out candies for every error they could spot. This worked well! Most of the graphs they later made and included in their papers were well done, and avoided the pitfalls I had worked into the "bad graph."

  As preparation for this class, I had students read two published papers and think about the way they were organized. I asked them to break each one down by identifying major sections of the paper, listing the type of information presented in each section, and identifying the question each section was designed to answer. I later summarized this into a handout which I distributed. However, this exercise did not seem to have been very effective, as shown by the subsequent lack of organization in the papers students wrote and submitted.

Is there some way I could adapt the collaborative nature of the graph exercise into another exercise which addressed the organization of the body of the paper? One way to do this would be to provide students with a section of a paper from a previous year and have them do an organizational critique as a class exercise.

- I plan to have groups meet with me individually to discuss the data analysis part of their paper (which I usually suggest they write first). Perhaps they would have to complete something and give it to me in advance, or maybe it would be much more informal. I would hope that this would both make the data analysis better, and direct students' focus onto what is the most important part of a technical paper.

- I might give them a published paper with the abstract missing, and have them write their own abstract – then have them exchange that piece of writing with someone else in class, and have each write a critique based on a set of guidelines from me. Then, having commented on someone else's work, they would get their own abstract back and critique it, before reading what others wrote about their abstract. Finally, they would read the "real" abstract & critique it.

  I might also try this approach for other sections of the paper they are currently working on. In treating sections of the paper as individual pieces with their own specific purposes, I would anticipate that students would become more attuned to the ways in which they should organize their own work.

- Perhaps I could have students do some free writing in class. This would get them started writing *something*. I might have them write about problems they were having with their experiment, as a way of priming them for a conversation with their lab partner or the class. I have never experimented with free writing before, so this would be a very different approach for me.

  If I didn't use free writing in class, I might use Moodle Forum to have students write a "letter to the class," or a letter to me. This would be a way to get students to articulate what they're thinking about, having trouble with, and so on, to which they could attach a couple of paragraphs from their paper.

Thanks to everyone who helped put together the Writing Fellows program!