ASSOCIATION FOR BIOLOGY LABORATORY EDUCATION

Although the laboratory exercises in this proceedings volume have been tested and due consideration has been given to safety, individuals performing these exercises must assume all responsibilities for risk. The Association for Biology Laboratory Education (ABLE) disclaims any liability with regards to safety in connection with the use of the exercises in this volume.

The focus of ABLE is to improve the undergraduate biology laboratory experience by promoting the development and dissemination of interesting, innovative, and reliable laboratory exercises.

Visit ABLE on the Web at:
http://www.ableweb.org

Using Calibrated Peer Review (CPR) to Improve Student Communication Skills

Todd Nickle

Mount Royal College
Calgary, Canada
tnickle@mtroyal.ca
©2006 Todd C. Nickle

Introduction

I believe one of the most critical skills that any post-secondary instructor needs to be aware of is that of clear communication. Regardless whether a student actually does understand an issue, if he or she cannot communicate what they know, their hard work becomes almost worthless. This is particularly true when describing the connections between cause-and-effect that underlies much of science research.

During my mini-workshop at ABLE 2005 I conducted a straw poll of participants around the topic of communication skills in science. Most respondents indicated that communication in science is "extremely important". None agreed with the statement "Students can learn all they need to about writing by following a styles guide", nor did any rate the ability of freshman students to write a multi-page work as "good" or "very good". Most indicated that students would benefit from substantially more practice, but that neither students nor faculty would be very receptive to the increased workload. Most polled participants did not feel students were entering college/university with sufficient skills to deal with the writing demands required of them. These results are summarized in Table 1.

It's my belief that student reluctance in addressing writing issues is mostly a matter of practice, and this seems to be supported by the poll. Students are uncomfortable with the role of wordsmith as they've not had sufficient opportunities to communicate using a multi-paragraph ("essay") format.

As faculty, we often have classes of hundreds to deal with. How can we require more writing and give feedback on it? I also am concerned that the difficulties my students have with textbook material stems from the disconnect in a reading – writing –reading feedback loop (the more you read, the better you write, and the better a reader you become). The "Writing Intensive" and "Writing Across the Curriculum" approaches to education have been adopted by some institutions (for example The University of Hawaii and Tufts University) with this in mind. A lot of effort and some expense, such as creating low-enrolment sections, are usually required for this.

Table 1: Audience responses during the CPR mini-workshop at ABLE 2005. Responses were gathered using 10 eInstruction clickers which were pseudo-randomly (that is, handed out to people in the first three rows) distributed to the audience.

Question	Responses				
How important is clear communication in science?	Not at all 20%	Minimal	Moderate	Very	Extremely 80%
"Students can learn all they need to about writing by following a styles guide." How do you feel about this statement?	Strongly disagree 70%	Disagree 20%	Neutral 10%	Agree	Strongly agree
Rate the ability of your average freshman student to write a multi-page work	Very poor 10%	Poor 40%	Modest 50%	Good	Very good
"Students would benefit from substantially more practice with open-ended essay work." How do you feel about this strategy?	Strongly disagree 10%	Disagree 10%	Neutral 30%	Agree 30%	Strongly agree 20%
How receptive is "the average student" towards the idea of their creating a multi-page work?	Very unreceptive 40%	Somewhat unreceptive 50%	Ambivalent 10%	Eager	Very eager
How receptive are YOU towards the idea of marking the multi-page work for an entire class?	Very unreceptive 20%	Somewhat unreceptive 20%	Ambivalent 40%	Eager	Very eager 20%
"Students are sufficiently prepared for college-level writing in High School." How do you feel about this statement?	Strongly disagree 40%	Disagree 50%	Neutral 10%	Agree	Strongly agree
"Students get sufficient education about writing in their freshman year in university." How do you feel about this statement?	Strongly disagree 10%	Disagree 30%	Neutral 40%	Agree 20%	Strongly agree
"Biology education should not include instruction about how to write clearly." How do you feel about this statement?	Strongly disagree 80%	Disagree	Neutral	Agree	Strongly agree 20%

Calibrated Peer Review (CPR)

The chemistry instructors at UCLA were concerned about their students' abilities in the realm of writing, and set about developing a way to provide an opportunity to not only write more, but to learn how to identify good and bad writing practices. Being aware of these practices makes it less likely that the students will commit them. With this in mind, these instructors designed the CPR database and marking algorithm.

So far, CPR is a free utility. There has been some discussion about a portable version (one that can reside on an institution's own server), but at this time I'm uncertain where that stands. I do know there's active work on assessing CPR effectiveness, but this will probably be difficult due to the subjective nature of evaluating written work. Certainly, conspicuous gains in writing ability won't suddenly materialize. Only through the constant pressure of demanding coherent work will we see better abilities in our students. Thus, the CPR community's efforts to promote this research are important but time-consuming.

CPR embodies the idea that "many hands make light work". When students themselves start providing feedback to other students, they become better critics and improve their own writing skills. The work is kept anonymous, so there are no privacy issues. When students review the work of others, they are sometimes

required to provide written feedback as to what was done well or what needs more work. Marks are calculated based on averages that are weighted according to the marking skill shown during calibrations.

The CPR process requires two main phases. *Text Entry* followed by *Calibration and Review*. You may find it convenient to take the CPR tour at http://cpr.molsci.ucla.edu/cpr/tours/student/stop1.asp before reading the next section.

Phase 1: Text Entry

In this phase, students access online materials such as reference websites, articles, or simulators, and then write an essay according to clearly-defined specifications. There is a minimum and a maximum word limit set by the instructor. Students can revise or update this essay as many times as they want until the first phase expires.

I typically give students two weeks to enter their text, although the vast majority do not begin this work until one or two days before the deadline. Ah, well... (*heavy sigh*).

Phase 2: Calibration and Review

When text entry is complete for all students, they can then calibrate on three essays that I myself wrote on the topic. They must evaluate one exemplary essay, one done poorly, and one that's mid-range. These are presented unlabelled and in random order. Students are guided by questions that ask if particular (often desirable) features are present in each work such as "Is the information organized into paragraphs: yes or no" or "Rank the quality of the introductory sentence: A. Vaguely related to the essay topic   B. Mostly related to the essay topic or C. Perfectly related to the essay topic."

Every essay and every evaluation of student work uses the same guiding questions. Some parts require the evaluator to provide comments to the author. This feedback can guide the author to identify good features of their work and acknowledge areas for improvement. Note the A/B/C example question can be interpreted as ambiguous. I believe that it is important for students to learn to deal with ambiguity, and that the very nature of grading essays is not clear-cut – even for instructors!

Students are rated by CPR according to how well they address the calibration essays. If the answers they give on each calibration matches the instructor's key, it's as if the instructor marked the essay. This student is considered a reliable grader and is given a "Reviewer Competency Index" (RCI) of 6. This means that the grade this reviewer gives to students will be weighted heavier than a student with a lower RCI, which means that the other student deviated on the calibrations by a greater amount.

After calibrating, the student is presented with essays written by three other students. Using the same guiding questions, each essay is evaluated and comments solicited. The score given by the student is used to provide a weighted average which then is compared to the reviewer's answer. If they are all in agreement, then the reviewer receives full credit for the review work. Essentially, this rewards student honesty: if they grade the work as fairly as they can (neither too high nor too low compared to other reasonable markers), they are entitled to credit for their work.

One of the strengths of CPR is that it gives the student a chance to evaluate his or her own work at the end, using the same questions they used to evaluate the work of others. This self-evaluation has an interesting scoring mechanism; the student grades his or her own paper from 1 to 10. Like the evaluations the student did on work from colleagues, points are awarded not for the magnitude of the grade they give, but rather on how closely it agrees with the weighted average from their own reviewers. Honesty pays!

Student Responses to CPR

Students would be hard-pressed to admit actually liking CPR, and in some cases there is outright hostility. All students suffer from concerns of over-work, and in some cases this is worsened by scheduling too many working hours per week. Some communicate a sense of "This is biology! We already know how to write, and it's not fair that you make us do it."

My own feeling about this is that if writing came easily, then CPR is trivial. If it's difficult and takes up a chunk of time, then it's practice well-needed. The scoring system of CPR is such that it's not uncommon to get class averages of 85% (though the "easiness" of grading can be adjusted in the instructor's control panel – I keep it lax but only assign a small portion of their grade to these exercises.

My Own Impressions of CPR

It's a lot of work, but worth it. I do get anecdotal information from other instructors that they can identify writing that seems more coherent than they usually see. One pointed this out to the student, who indicated that she felt she benefited from CPR practice. CPR exercises point out common errors students commit when writing parts of a Lab Manuscript (I don't dare call it a "report", as some of our chemistry faculty require "lab reports" that consist of little more than a table with a name in the corner).

There's a modest learning curve for running a CPR program. Like most sophisticated assignments, it's more the construction of the guiding questions and introduced flaws in the calibration essays that require effort. The control panel for instructors allows me to help students along and adjust deadlines as individual circumstances require. Sometimes the CPR site is inaccessible from our part of the world, and this proves quite frustrating to students.

All in all, though, there's no equivalent to this method of addressing the writing skills of a large cohort of students. I oversee about 550 students a year (at three essays apiece) without the need for any more manpower. CPR does not replace feedback from work properly graded and commented upon by an expert. Instead, it provides students an avenue to practice the craft of writing and receiving in turn some feedback on how to improve. Writing is work, but it's worthwhile work.

For our "capstone" manuscript at the end of the semester, the incidence of sloppy citations went down after CPR exercises. Interestingly, before CPR could tell them how to reference, we would put it in their lab manual, and we'd even create a text box warning how to reference, and yet we'd find full URLs in the Introduction and Discussion sections. Only by getting "burned" in the assignment would many students take notice of the convention.

My CPR experience has been sweetened with 1) having tenure, and 2) having full buy-in and backing from our department chair and the Dean of Science and Technology. They have bought into the goal and desperate need to increase student writing skills in the sciences. The occasional hostile "student evaluation of instruction" is expected and does not undermine the progress that CPR in my classes has allowed.

CPR provides me with a fair, low-threshold activity that addresses what I believe is a critical issue for my students.

Links
- CPR main page: http://cpr.molsci.ucla.edu/cpr/cpr_info/
- CPR tour: http://cpr.molsci.ucla.edu/cpr/tours/student/stop1.asp
- Todd's ABLE PowerPoint presentation: http://www2.mtroyal.ca/~tnickle/ABLE/CPR.ppt
- Todd's orientation to students for CPR: http://www2.mtroyal.ca/~tnickle/CPR/

About the Author

Todd Nickle graduated with his PhD in Botany from Oklahoma State University in 1998, and has since taken a faculty position at Mount Royal College in Calgary, Canada. He's been an active participant in ABLE meetings since 2000 and is ever-eager to discuss teaching philosophy and activities to improve his abilities. Contact Todd at tnickle@mtroyal.ca