

# Contemporary Chemical Essays: Dealing with the Writing Problem in a Freshman Chemistry Course

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The need for writing skills is self-evident, not only as a mark of the educated man or woman, but also as a necessary skill for effective employment. It is a need common to science and all other professions. While chemistry faculties have not generally identified writing skill development as important in their sphere, the increased emphasis on the problem requires that we reassess our role. The only traditional activity, the written laboratory report, lacks the opportunity to develop two of the more important skills, organization and imagination, because of its structured format. Evaluation of such reports has tended to focus solely upon the technical result.

Beyond the formidable problem of training the scientist to write well, chemists share with colleagues in other disciplines the responsibility to address the need for other students. For the course for the non-science major at the freshman level, the authors have developed the "contemporary chemical essay" as a pedagogical tool. In the beginning of this effort in 1977, we felt that some demonstration of writing competence was only reasonable to expect from students who were not being asked to bring a high level of mathematical ability to the study of chemistry. The approach taken then was to require that all students submit a substantial essay based on a subject related to the content of the course. The specific topic was based upon an assigned article taken from current scientific literature at an appropriate technical level.

The course syllabus is designed to present issues of contemporary life with a chemical perspective. Chemistry 111 "Chemistry of Life Processes," a one-semester course, does not require a previous high school course; thus, some coverage of fundamentals is required. This leads to a unit of organic chemistry followed by biochemistry. Several issue-oriented topics are then presented; namely, foods and nutrition, drugs and drug abuse, polymers and textiles, toxic substances, and soaps and detergents. Chemistry 121, "Chemistry, Technology, and Environment," is considered to stand alone as a semester course. Many students, however, take it immediately after Chemistry 111. Those who elect to take only the second

course must have a high school chemistry background, thus obviating the need to dwell on fundamentals again. In this course, issues discussed include energy, air and water pollution, metals, solid wastes, and organic chemical wastes, and finally a discussion of social aspects titled, "Science, Politics, Ethics, and Problem Solving." These subjects are integrated in a context where a survey of physical, inorganic, and analytical chemistry topics is covered.

As part of the syllabus at first class meetings, students are presented with the following instruction:

## Contemporary Chemical Essays

Each student is required to submit an essay of three to five double-spaced typewritten pages, based upon a topic addressed in assigned articles taken from current scientific periodicals. The essay must be original, include library research beyond the original article, contain your own conclusions on the subject, and be written in acceptable English. There will be ten opportunities for you to select a topic during the term. A student may select any one topic and may submit a second essay to improve upon the first grade.

A first essay assignment was made immediately with a deadline date two weeks later. Access to the assigned article was made through the reserve desk of each of the two major libraries on campus. Some attempt to correlate the articles with lecture topics is of obvious benefit, yet the assignment needs to be distinct from classroom or laboratory materials. The additional factor of importance is that the technical content be challenging but not overpowering. Many articles were chosen from the current literature, yet the option of choosing older material is perfectly appropriate. An example list (see Bibliography) from a 1979 section reflects both types. A fa-

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vorite classic from the older literature is the treatise, "What We Must Do," [J. Platt, *Science*, 166, 1115 (1969)], a discussion of the societal importance of technological change in the twentieth century. There are plenty of such appropriate articles. The bibliography contains a further list of papers appearing in the literature in April 1980, which illustrates the range of possibilities.

While a chemistry professor might have some trepidation, our experience was that evaluation is reasonably straightforward, after a time. The four criteria used to evaluate the project were those stated in the assignment. That the work be "original" is obvious, and even more obvious is the occasional attempt to plagiarize. The system is not subject to the "essay-for-hire" hucksters, for the reason that the essay must relate to the article, rather than a broader approach. A few student plagiarists were identified and dealt with. There is a substantial difference in the maturity of thought and style between that of the best young writer and that of other published sources.

While some treatment of the assigned article was anticipated, it was required that additional sources be incorporated. Therefore, students were required to show evidence in the paper of "additional library research," both in the text itself, and in the bibliography. In some instances, assigned papers presented a bias on an issue, and students who perceived that and presented evidence on the other side were particularly rewarded.

The third criterion was that the essay "contain your own conclusions on the subject." The exercise enables students to examine opposing viewpoints and thereby to test their own judgment. Most do not choose to take an opposing view from the assigned article. The ability to see something written on paper as less than sacrosanct is a skill that needs to be developed in many. So is the ability to think beyond an action (such as banning a commercial product) to the possible backlash reactions of greater consequence than the status quo.

Finally, the writers needed to write "in acceptable English." The writing capabilities of students in this course are not very good—even in an institution whose students score well above the average on entrance. There is some reason to be encouraged, however. In the four years that this project has been under way, some improvement in usage has been observed, perhaps because of better high school experience. The students also appear to benefit from criticism. Those who choose to write a second essay generally improve their mark by about one letter. How many bad writers are there in the working world, who are unaware of major but correctable deficiencies, and whose work suffers accordingly, because of the failure of a teacher or supervisor to offer constructive criticism?

Foremost among usage deficiencies are spelling errors and misplaced commas. Improper sentence structure and poor paraphrasing practices are frequent. Two of the most rampant errors are improper uses of the possessive pronoun "its" and the contraction "it's." Many students use only one or the other without distinction. The misuse of the verbs "affect"—"to influence or change"—with "effect"—"to achieve or be the cause of"—is pandemic. So is the more obvious failure to distinguish that "effect" serves as a noun. Webster provides

only limited use for "affect"—when feeling or emotion is involved.

Grading essays was based upon a letter grade scale with provisions for plus or minus scoring. The assignment of letter grades leaves obvious room for uncertainties, but given this inevitability, quality and its absence become easy to judge. It is important to note each error and to give some overall guidance on the quality of both substance and style to the writer. Even in a large class, the time of senior instructor is probably well spent, with the added advantage of learning about student attitudes toward the issues and the degree to which the study of chemistry changes their perspectives. To read as many as 269 papers in one semester was not an intolerable burden.

The letter grades were transposed to numerical scores and incorporated into a computerized gradebook system. In a course which included four long examinations, several quizzes, and a laboratory, the essay counted for 5 percent of the final grade. This was sufficient incentive even for those students not strongly motivated, due to the possibility of an incomplete grade.

For the student, this assignment did not prove to be excessive work, nor did it distract from traditional activities in the course. The reward of seeing improved writing skills along with the benefits of the attendant library work and reading make this a worthwhile effort, even given a significant commitment of time to grading.

#### Assigned Articles for Chemistry 111

- (A) Assigned Articles for Chemistry 111, Fall 1979
- (1) Anon., "Acid from the Sky," *Mosaic*, pp. 35-40, July/Aug (1979).
  - (2) Ember, L., "The Specter of Cancer," *Environ. Sci. Tech.*, 9, 1116 (1975).
  - (3) Greden, J. F., "Coffee, Tea and You," *Sciences*, (NY) 19, 1, pp. 6-10 (1979).
  - (4) Guerin, J., "Chemical Feelings," *Sci. Eighty*, 7[7], 28-33 (1979).
  - (5) Jelliffe, D. B. and Jelliffe, E. F. P., "Human Milk, Nutrition and the World Resource Crisis," *Science*, (Washington, DC), 188, 557 (1975).
  - (6) Maugh II, T. H., "Toxic Waste Disposal—a Growing Problem," *Science*, (Washington, DC) 204, 819 (1979).
  - (7) Ochsner, A., "The Health Menace of Tobacco," *Amer. Sci.*, 59, 246, (1971).
  - (8) Wade, N., "Synfuels in Haste, Repent at Leisure," *Science*, (Washington, DC), 205, 167 (1979).
  - (9) Weinberg, A. M., "The Maturity and Cheapness of Nuclear Energy," *Amer. Sci.*, 64, 25 (1976).
  - (10) Wittwer, S. H., "Food Production: Technology and the Resource Base," *Science*, (Washington, DC), 188, 579 (1975).
- (B) Assignments from Literature of April 1980
- (1) Abrams, N. E. and Primack, J. R., "Helping the Public Decide: The Case of Radioactive Waste Management," *Environ.*, 22[3], 14 (April 1980).
  - (2) Anon., "Scientists and International Politics," *News Forum, Chem. Eng. News*, 58[16], 37 (April 21, 1980).
  - (3) Davies, P. C. W., "Antimatter: Mysteries of a Divided Universe," *Sciences* (NY), 20[4], 10 (April 1980).
  - (4) Gori, G. B., "The Regulation of Carcinogenic Hazards," *Science*, (Washington, D.C.), 208, 256 (1980).
  - (5) Greek, B., "Soda Ash Outpaces Other Chlor-alkalis," *Chem. Eng. News*, 58[14], 10 (April 7, 1980).
  - (6) Hayes, D., "The Unfinished Agenda," *Environ.*, 22[3], 6 (April 1980).
  - (7) Janos, L., "Timekeepers of the Solar System," *Sci. Eighty*, 1[4], 44 (1980).
  - (8) Jukes, T. H., "Antibiotics, Resistance and Animal Growth: Another View," *Sciences* (NY), 20[4], 24 (April 1980).
  - (9) Liu, B., et al., "Advances in Particle Sampling and Measurement," *Environ. Sci. Technol.*, 14, 392 (1980).
  - (10) Mammano, N. J., "A Chemistry Lesson at Three Mile Island," *J. CHEM. EDUC.*, 57, 386 (1980).
  - (11) Sarquis, M., (Editor), "Chemistry and Art," *J. CHEM. EDUC.*, 57, 255 (1980).
  - (12) Stork, W. J., "Pesticide Profits Belie Mature Market Status," *Chem. Eng. News*, 58[17], 10 (April 28, 1980).
  - (13) Whipple, C., "The Energy Impacts of Solar Heating," *Science*, (Washington, DC), 208, 256 (1980).
  - (14) Zaleski, C. P., "Breeder Reactors in France," *Science*, (Washington, DC), 208, 137 (1980).