

The Value of Scientific Peer-Reviewed Literature in a General Education Science Course

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THE peer-reviewed scientific literature is central to the deliberative structure of science. It has been described as “the major factor in keeping the scientific enterprise relatively honest” (Abelson 1980). A real understanding of the scientific literature is essential to grasping how science works and how it differs from other human endeavors. While undergraduate science majors often become familiar with the structure and function of the scientific literature, general education science courses aimed at nonscience majors rarely, if ever, require their students to become familiar with this central literature. Because of this, such students and citizens remain unaware of the most important deliberative structure of science.

I describe below a general education human genetics course that I offered at Washington State University's Vancouver branch campus. This course required students to write a term paper comparing an article in the peer-reviewed scientific literature with a popular article on the same subject. By doing this, each student became focused on one or a few papers in the scientific literature that were presumably chosen by the student because of substantial interest in the subject area. By comparing the structure, readability, documentation and other features of the chosen scientific article with one or more popular articles, the most important features of the scientific literature were highlighted.

Course Structure

One semester of college level biology was a prerequisite for the human genetics course. With the exception of the required term paper, this course was a relatively conventional lecture/discussion course. The class met three times per week for a semester, had three exams, and used Ricki Lewis' *Human Genetics* (Wm. C. Brown, Publishers, 1st edition) as a textbook. Thirty-five students registered for the course, thus providing a good class size for discussion.

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The four-to-ten-page term paper was required of all students, comparing an article in the peer-reviewed scientific literature with an article on a similar topic from the popular literature. The paper was to compare these articles in format, approach, citation and other documentation, readability, and any other substantial features. While most chosen topics were in the area of genetics/human genetics, I was relatively flexible in terms of what areas would qualify. To help the students prepare for writing their papers, I prepared a handout on and discussed each of several issues: how to recognize a peer-reviewed article, distinguishing, for example, non-peer-reviewed news articles from others and distinguishing peer-reviewed journals from others not peer-reviewed; the distinction between primary literature articles and review articles, including minireviews. Each of these issues was discussed in the context of helping the students prepare to write their papers but had the effect of simultaneously focusing students' attention on some of the most important properties of the peer-reviewed scientific literature.

Another issue that was discussed is that the medical literature is relatively accessible because it is written for the benefit of physicians who are not, primarily, scientists. Medical literature has much specialized nomenclature, consequently a good medical dictionary is always a useful resource; but once the nomenclature is deciphered, the papers are often quite understandable. Because we students and faculty alike often have occasions when we would like to understand the medical literature in a specific area because of its importance to our health or the health of family members or friends, there is a real incentive for students to learn to search and analyze the medical literature. This provides an important motivation for students to take their work preparing their papers very seriously because the skills they develop could be very important to them.

The scientific articles are typically read quite differently from other articles. They are rarely read from beginning to end and often are approached by skipping from the abstract to figures or tables or possibly to the conclusion section of the article. I tried to

give students a feeling for how one might approach reading such articles to gain the most from them.

Support for the Students & the Papers Produced by Them

The librarians in the campus library agreed to help students work with suitable databases to find appropriate articles in both the scientific literature and the popular literature. After each student had identified and obtained copies of some possible articles, each student met with me for about 30 minutes to go over his or her findings. Specifically, I helped each student with any difficulties he or she might have interpreting the articles or understanding the nomenclature in the articles. If a student were still uncertain whether the articles identified were the ones he or she should write about, I helped him or her perform further searches in Medline or other databases. Students were also offered the opportunity to have additional individual meetings with me, but only a minority of the students felt that this was needed.

While each student was required to review only two articles, many chose to review three or four to give them a broader framework from which to write their papers. Students were asked to turn in photocopies of the articles reviewed with their papers, so that I could simultaneously look at both the papers and the materials from which they were derived.

The students chose a diverse group of topics for their papers (see Table 1 for a list of some of them). However, two topics were chosen by more than one student. One was the cause of breast cancer, in which papers focused on either the role of the *BRCA1* gene or on the role of xenoestrogens. A second was the genetics of obesity and specifically the role of the *ob* gene and leptin. Both of these topics were chosen by several female students and their popularity among the students may reflect the fact that approximately 3/4 of the registered students were female.

As the instructor of the course, I drew several inferences from reading the term papers. Those papers that were written on similar topics were very different from each other, both in the articles reviewed and in the thrust and organization of the papers, therefore it is very unlikely that students collaborated on their papers. I felt that the quality of the papers was quite high, showing considerable thought on the part of most students. Overall, then, the class response was excellent! There was only one paper that overtly disappointed me. This was the paper on Agent Orange (#6 in Table I). The student writing the paper was able to find no substantial scientific evidence that Agent Orange was mutagenic but still did not pick up on this important difference between the scientific articles and the popular article that he

Table I. Term paper topics.

How Is the Etiology of Obesity Explained?
Breast Cancer Genetics—the Role of the <i>BRCA1</i> Gene
Hypertension Differences between Blacks and Whites
Artificial Reproduction by a Man with an Unusual Form of Cystic Fibrosis
Obesity—the Roles of Leptin and the Beta-Adrenergic Receptor
The Controversy over Genetic Effects of Agent Orange
Fossil DNA in the Popular and the Scientific Press
The <i>ob</i> Gene Cloning and the Cause of Obesity
Germ-Line Gene Therapy: Ethics and Morals
DNA Fingerprinting
Life after Chernobyl: Public Views and Scientific Data
Genetic Control of Breast Cancer
Xenoestrogens and Possible Connection with Increases in Breast Cancer
Polycystic Ovarian Disease
Genetic Testing for Victims of Sexual Assault
Tourette's Syndrome
Genetic Engineering and Food Production
<i>BRCA1</i> Gene
Treatment of Parkinson's Disease: Neurological and Ethical Perspectives
Down's Syndrome
DNA Fingerprinting Methods
The Induction of Ectopic Eyes in <i>Drosophila</i>
The <i>ob</i> Gene
The Cloning of Human Embryos
Rise of Antibiotic-Resistant Diseases

reviewed—in a conflict between data and opinion, the data should win!

Originality & Applicability of Such Term Papers

I have searched the ERIC database using several search strategies to determine if other general education science courses have required similar term papers based on peer-reviewed scientific literature. One of our librarians has performed similar searches using the Article First database. Although several hundred papers were found from these searches, none contained a description of any similar approach in a general education science course. The closest thing to it was based on a science-in-the-news approach but did not involve any peer-reviewed reading (Van-Deventer 1977). I believe, therefore, that the approach described here is probably unique.

Conclusions

Where Can This Approach Be Most Usefully Applied?

What other courses could effectively use the approach described here? In order to judge this, it is useful to list some of the features that made this term paper so successful in the context of a human genetics general education course:

1. There are many potential topics of great intrinsic interest to students.
2. Much of the literature, especially the medically oriented literature, is relatively accessible.
3. Learning to search and analyze the medical literature can be seen to be of real value to students in their lives.
4. It is relatively easy to find articles in both the popular and scientific literature on similar topics.

Of these four points, all may be helpful in requiring students to write similar papers in the areas of nutrition and health, as well as in human genetics. Papers in a general education ecology course might be supported by points 1, 2 and 4, but not by 3. So, I suggest that similar papers might be most effectively

required in general education science courses in these three areas but possibly not in other areas.

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