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Annotated bibliography: Incorporating rhetoric into the scientific writing course
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This bibliography is intended to provide a sketch of the relevant literature for instructors interested in incorporating a rhetorical approach to writing into the scientific writing class. It might also be useful for those interested in the rhetoric of science writing. The papers presented here can broadly be grouped into three categories. First, two authors focus on the philosophical reasoning behind their support of teaching scientific writing from a rhetorical approach (Dobrin; Miller). Although these authors take a possibly alienating position (for science students) that it is imperative for the humanities to step in and rescue scientific writing from a narrowly formalist and amoral positivism, their ideas could provide good points for discussion.

Several of the articles surveyed provide examples of courses structured in different ways. These include a dual laboratory-writing component to a chemistry course (Alaimo, *et al.*), a stand-alone scientific writing course (Carpenter & Krest), and a writing course taught in tandem with a biology course (Wilkinson). These authors provide useful critiques of these models.

Finally, several articles focus upon the rhetorical elements of scientific journal articles, in many ways the primary genre of the sciences. Examples include the use of language situating the author within the discourse community in geology field reports (Dressen), the general structure and stylistic conventions of the research paper (Gross; Hamilton; Smagorinsky), the use of hedging or qualifying terms (Lewin), conventions for citation (Martinez), and common *topoi* or forms of proofs (Walsh). These articles provide interesting perspectives on this genre which could be incorporated into a scientific writing course.

There are several potentially useful topics for scientific writing instructors that this bibliography does not include. For example, in each of the course accounts it seemed to be taken for granted that a rhetorical approach to teaching scientific writing was the most appropriate. It would be useful to compare the results of teaching from the rhetorical perspective to other approaches, such as a formalist approach. Also, while these researchers reject the formalist approach fairly forcefully, it might be interesting to see how prevalent it currently is in scientific writing courses. It would also be useful to explore writing across the curriculum and writing within disciplines approaches to teaching scientific writing further.

Alaimo, Peter J., John C. Bean, Joseph M. Langenhan, and Larry Nichols. “Eliminating Lab Reports: A Rhetorical Approach for Teaching the Scientific Paper in Sophomore Organic Chemistry.” *The WAC Journal* 20, 2009. 17-32. Print.

In response to poor writing in senior undergraduate chemistry theses, Seattle University instructors restructured the sophomore chemistry course. Previously, this course had included writing as lab reports, a psuedotransactional genre, and "cookbook" experiments. The authors redesigned experiments to require exploration and inquiry, scaffolded writing assignments toward an understanding of the scientific paper genre (beginning with sections not requiring synthesis, and progressing to more difficult sections), and provided structured writing feedback Students were explicitly instructed about the rhetorical reasoning and connections between different sections of the paper. The authors' theoretical rationale focuses on the role genre plays in enculturating students into the chemistry discourse community. They chose to focus on writing within a

sophomore science lab, rather than in a separate scientific writing course, as the appropriate approach to encourage thinking "like a chemist" (19). In a standalone scientific writing course, it would not be possible to replicate this type of experience within students' disciplines, which from this perspective would be a weakness. However, in a standalone course it should be possible to scaffold instruction about the sections of a major paper in a similar way- focusing on the material requiring less synthesis first, then addressing progressively more difficult material.

Carpenter, J. Harrison, and Margie Krest. "It's About the Science: Students Writing and Thinking About Data In a Scientific Writing Course." *Language and Learning Across the Disciplines* 5.2, 2001. n.p. Web.

Carpenter and Krest report several case studies from an upper-division scientific writing course with three key goals: focus on teaching students to understand both science and scientific data, teach students how scientists use genre in specific rhetorical situations, and show students rhetorical tools that they can then apply flexibly to their writing. They take a "generative," rather than formalist, approach to genre; for example, they teach students to use genre conventions to accommodate both their own goals and the "needs of the field". Four assignments are taught: a lit review, a deliberative essay, an article critique, and a research proposal; the format for these assignments is somewhat flexible, based upon the interests of the students. They also incorporate multiple opportunities for revision, linking these to the need to revise in professional publishing. They outline several "shifts" in thinking that students should ideally gain from their course (though not all do): learning to learn and interpret data, learning to frame an issue in scientific terms, and learning to navigate the complexity of scientific topics. They emphasize the importance of situating a scientific writing course in an appropriate environment. Ideally, students would practice critical thinking and writing in other courses and have access to mentoring opportunities that begin to enculturate them into a scientific community, and science faculty would support the idea of teaching writing as something more than a "formalistic exercise."

Cooper, Amy, and Dawn Bikowski. "Writing at the Graduate Level: What Tasks do Professors Actually Require?" *Journal of English for Academic Purposes* 6.3, 2007: 206-221. ScienceDirect. Web.

In this article, the authors looked at 200 syllabi from various disciplines to determine the types of academic writing done across disciplines. They found that natural science, math, and engineering courses typically required less writing assignments than social science and humanities courses, and that fewer genres of writing were assigned. Library research papers and research project reports were the most common genres assigned across both categories. However, by grouping disciplines into natural science/math/engineering and social science/humanities/arts categories, the authors may have missed variability within these categories. Their rationale for separating social sciences from natural sciences and engineering is also not clear. This article's focus is on graduate student writing within college (specifically, types of writing that non-native English speakers may encounter as students), rather than processional writing after graduation. While this is a fine distinction for some disciplines, for scientific writing there are some fairly large differences. However, it does provide a broad analysis of the types of research tasks that students are

likely to encounter in graduate school, and concludes by explicitly calling attention to skills that may be transferred to other scholarly writing tasks.

Dobrin, David N. "What's Technical About Technical Writing?" *Central Works in Technical Communication*. Eds. Johndan Johnson-Eilola and Stuart A. Selber. Oxford University Press: New York, 2004. 107-123. Print.

While this paper centers on the definition of technical writing, Dobrin also addresses the distinctions between technical writing and scientific writing. His primary distinction is that scientific writing makes a truth claim, and technical writing does not. Scientific writing is provisional, and any single statement only has meaning insofar as it is accepted into the scientific discourse community. Dobrin also discusses two views of language, a "universalist" view that suggests that language can convey a single meaning, or truth, about the natural world, and a "monadist" view that says that language is so intertwined with human understanding that it is not possible to use language to convey universal truths. He goes on discuss the political implications of adopting a falsely objective standard for technical writing (in the universalist tradition), and instead advocates a style of writing that "accommodates technology to the user". Although the primary focus of this article is not scientific writing, Dobrin's discussion of the "universalist" and "monadist" philosophies of writing may be useful concepts for the scientific writing student.

Dressen, Dacia. “Geologists' Implicit Persuasive Strategies and the Construction of Evaluative Evidence.” *Journal of English for Academic Purposes* 2.4, 2003. 273-90. Print.

This paper presents results of a genre analysis of geology field research articles. Historically, credibility in geology depends to a large extent upon doing field work, with field geologists being higher-status than laboratory geologists. To gain credibility within this discourse community, geologists must employ several writing strategies in their papers, including understatement (particularly about difficult or dangerous field conditions), drawing attention to the researcher as an active participant in the field work (both directly and indirectly), and using appropriate terminology and "metadiscoursal cues" (e.g., combining terminology, citing previous researchers). Dressen points out that, even though scientific language appears distanced and impersonal, by focusing on the conventions of a single subfield we can pick out themes that are related to that field's culture. This paper would actually be a good example of rhetorical usages of language in scientific journal articles to provide to students in a scientific writing course.

Gross, Alan G. “Does Rhetoric of Science Matter? The Case of the Floppy-Eared Rabbits.” *College English* 53.8, 1991. 933-43. Print.

Scientific journal articles are often described as arhetorical (or at least blind to their rhetorical nature), incorporating needlessly convoluted prose in need of fixing. Gross instead describes the style of the scientific journal article as a set of rhetorical conventions that are, in fact, quite effective at communicating science within the scientific discourse community. For example, passive voice is appropriate in this context because it allows events and objects (the subjects of scientific inquiry) to become the subjects of sentences, unlike active voice, which requires that a human actor be the subject (he does, however, acknowledge that passive construction can be clumsy). Gross also discusses how tables

and figures support scientific arguments, and how the structure of the scientific report supports the polite fiction that scientific knowledge is constructed through a process of induction. He suggests teaching the research paper genre as a rhetorical response to the structure of the scientific enterprise. Students should be exposed to critical reflection on scientific writing, but teachers should be careful to situate criticism within the conventions of the scientific discourse community.

Hamilton, David. "Writing Science." *College English* 40.1, 1978. 32-40. Print.
In this essay, Hamilton discusses some of the characteristics of scientific writing, and discusses how students learn to do it. He refers to this type of writing as "easier" than other types of writing (e.g., history and philosophy), in that it refers to interesting things that are tangible and understandable. As students become immersed in science, their writing improves; he makes the distinction between writing *about* science and writing as *doing* science. Students learn scientific writing best when incorporating it into the science they are actually doing and thinking about critically, rather than writing about science being done by others. According to Hamilton, students writing about their experiences pay more attention to the experimental details being presented in their words, and their sentence structure and word choices improve as a result. However, these are several things that scientific writers should be cautious about, including excessive use of passive voice and reducing the subjects of their research into component properties (e.g., referring to tapeworms by their length and weight, rather than as "worms"). He feels that this reductive use of language limits scientific knowledge to details, rather than to a more holistic level of understanding.

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In this essay, Hamilton reflects on his previous thoughts about scientific writing, while incorporating the results of his discussions with scientists and scientists' writings about how they read scientific papers. In one example, he focuses on how the scientific paper emphasizes the accurate dissemination for facts, and minimizes the discussion of the broader implication of findings. As Hamilton sees it, scientific papers are designed to present a set of facts with a tentative interpretation, but then the scientific readers use those facts to come to their own conclusions. He also describes discussions among scientists about other aspects of scientific writing, such as the structure of scientific papers and what this implies about the scientific process, the use of obfuscatory language, and replacing "I" with the "fraudulent we". Hamilton compares scientific papers to reports, rather than literature, and suggests that their conventions are useful in that context. He concludes by suggesting that scientific writing courses teach reading (rather than just writing) skills, and focus on the scientific research paper for the bulk of the semester. His approach to the research paper is different from other authors'; he suggest assigning a class "simulation" of research and then experimenting with different ways of presenting that information, rather than having the students focus on their personal research.

Lewin, Beverly A. "Hedging: An Exploratory Study of Authors' and Readers' Identification of "Toning Down" in Scientific Texts." *Journal of English for Academic Purposes* 4.2, 2005. 163-178. Print.

Lewin focuses on differences in perception of hedging of claims in scientific papers among authors and readers. Hedging has been shown to increase retention of information and improve the attitude of readers toward content. According to Lewin, it allows readers to take a more active role in constructing the meaning of the text, but it also signals that the information being presented might upset the status quo and that tentative language is called for until that information is accepted by the discourse community. Lewin asked 14 scientists to identify hedging language in one of their papers, analyzed those papers according to a linguistic definition of hedging, and asked student readers to identify hedges. She found that scientific writers' perception of hedging differed greatly from traditional definitions, and that readers' perceptions were more similar to the linguistic interpretation. While this was an exploratory study, it did provide some support for the idea that certain types of hedging in the scientific literature are normalized to the extent that, for scientists, they are not intended as hedging.

Martinez, Iliana A. "Building Consensus in Science: Resources for Intertextual Dialog in Biology Research Articles." *Journal of English for Academic Purposes* 7.4, 2008. 268-276. Print.

Martinez reviews research on the purposes and conventions of citation in scientific journal articles. Citations occur for multiple reasons, including providing introductory information, providing support for arguments (or conclusions to be argued against), validating prior claims in the field, demonstrating progression in the author's own research program, and as a "*quid pro quo*" for citations in other authors' papers. Focusing on persuasive use of citations, Martinez analyzes the purpose of explicit rhetorical "moves" in which citations are found. While the number of papers she analyzed did not allow for broad generalizations, she did see differences in form and purpose of citations in the different sections of papers. For example, more comparative citations were found Discussion sections, whereas citation for the purpose of review occurred solely in the Introduction. Authors also engaged in a higher level of self-citation later in papers, suggesting that self-citation is most appropriate once the research at hand is well-situated within the field of study. Martinez suggests that calling students' attention directly to the differing functions of citation in different parts of the research paper can help them write more effectively.

Miller, Carolyn R. "A Humanistic Rationale for Technical Writing." *Central Works in Technical Communication*. Eds. Johndan Johnson-Eilola and Stuart A. Selber. Oxford University Press: New York, 2004. 47-54. Print.

Miller discusses both scientific and technical writing, differentiating them from literary writing in that they are often taught from a positivist perspective that tries to separate "reality" from uncertain human language and emotion. The purpose of scientific writing is to transmit sensory data in a form that is as unadulterated as possible by messy and inexact language. Miller argues that this non-rhetorical view of scientific writing dehumanizes its practitioners and readers. More pertinently to teaching writing, the positivist infiltration of the technical writing course results in negative outcomes: unclear prose using only passive voice, privileging of style over invention, and picturing the audience in terms of "levels" of understanding. Instead, Miller suggests that scientific and technical writing instructors emphasize that human knowledge is never absolute, certain, or objective. If

knowledge is relative and socially constructed, then teachers must emphasize the rhetorical nature of scientific writing for students. The scientific writing course should enculturate students, rather than teach them a set of skills.

Smagorinsky, Peter. "The Method Section as Conceptual Epicenter in Constructing Social Science Research Reports." *Written Communication* 25.3, 2008. 389-411. Print.

Smagorinsky argues that the Methods section of many modern social science research papers does not serve its intended function: to enable readers to exactly replicate the described research. He suggests paying careful attention to the components of data collection, data reduction, data analysis, coding process, and context of the investigation. For Smagorinsky, the Methods section serves as the central feature of the research paper, and the Results and Discussion sections should refer back to it. He also argues that, by writing the Methods section first, the author clarifies her understanding of what she will need to incorporate into the paper, in terms of a review of past literature. Under-written Methods sections also make it impossible to admit a research article into the scientific discourse with a high degree of confidence in its results.

Walsh, Lynda. "The Common Topoi of STEM Discourse: An Apologia and Methodological Proposal, With Pilot Survey." *Written Communication* 27.1, 2010. 120-156. Web.

In an exploratory study, Walsh identifies several categories of common *topoi* in scientific writing. These include field-specific, science-wide, and Aristotelian *topoi*. She argues that by categorizing writing (or figures) in a topical way, we can see "what a STEM worker both gains and gives up in a particular approach to a data set" (125). *Topoi* in scientific writing assist invention, helping scientists make both verbal and visual choices. Walsh connects her approach to pervious attempts to find commonalities in scientific papers from a linguistic perspective. While a rigorous topical analysis of scientific writing would likely be too difficult for a scientific writing class, this approach is similar to Swales' CARS model of research introductions in that it can help students model the types of arguments that are most appropriate in the different parts of a scientific paper.

Wilkinson, A. M. "A Freshman Writing Course in Parallel with a Science Course." *College Composition and Communication* 36.2, 1985. 160-65. Print.

Wilkinson describes a writing course taught alongside a biology course, in which the assignments were weekly reports based upon the content of the biology course, a research proposal, and a research paper. The syllabi of the two courses were coordinated so that some assignments were done in tandem for both courses, and the only readings assigned were for the biology class. Wilkinson lists several drawbacks of this approach, including difficulty coordinating assignments, unsuitability of the subject matter for teaching a thesis-based style of writing, and little content knowledge on the part of the English instructors (even with biology course materials at their disposal). She also lists advantages: the lack of additional English readings meant that there was more class time for writing and revision; because all students were working on the same topic, in-class discussions were more productive; and students were motivated in their assignments because they all had interest in the content. Overall, the detailed collaboration between faculty members was more successful than non-coordinated attempts at writing across the curriculum. While Wilkinson does not explicitly discuss emphasizing the rhetorical

elements of scientific texts, this type of writing course could certainly be taught with a rhetorical emphasis.