STYLE AND THE PROFESSIONAL WRITING CURRICULUM: TEACHING STYLISTIC FLUENCY THROUGH SCIENCE WRITING

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INTRODUCTION

Recent scholarship on style and writing pedagogy suggests that rhetoric's third canon is experiencing a renaissance in composition studies. Anchored by recent monographs (e.g., Butler's *Out of Style,* Holcomb & Killingsworth's *Performing Prose*, and Johnson's *A Rhetoric of Pleasure*), rich collections (e.g., Butler's Bedford/St. Martin's anthology and Johnson & Pace's *Refiguring Prose Style*) and numerous articles, this corpus attempts to reposition *style* as central to the writing process and to writing pedagogy. But this refiguring neglects an important site for style-centered pedagogy—professional writing curricula.[1]

Whether its operating model is the single-shot service course or elective, a minor, a major, or a concentration within a major, a professional writing program should take style seriously. Unfortunately, professional communication texts often present narrow conceptions of professional style. For example, in a study of popular textbooks, Wolfe found that most general technical communication texts prescribe universally avoiding passive voice. For Wolfe, the "injunction against the passive" is a specific disservice to engineering students who will likely write reports requiring passive constructions—traditional markers of scientific styles (2009, pp. 355-358). She concludes, "In place of prescriptive injunctions against particular styles, we need more thorough discussions of the rhetorical considerations that prompt specific language uses" (2009, p. 358).

Empirical studies confirm that responding to variable stylistic demands is an important workplace skill. For example, Angouri and Harwood's case study of style in a multinational consortium indicates that stylistic expectations (e.g., the level of formality) for seemingly standardized documents (e.g., memos and minutes) vary widely, even *within* an organization. They suggest rethinking traditional model-based pedagogy: "Although models can serve valuable awareness-raising purposes, writing teachers need to stress how and why such models may bear scant resemblance to the templates and variations students may encounter on the job" (2008, p. 58). All students must develop a stylistic sensibility if they are to navigate the stylistic variability of professional life; such a sensibility is especially important for students planning careers as communication professionals.

Students planning to compete for jobs as writers and editors must develop stylistic fluency—a meta-mastery of style—if they are to adapt successfully to the rhetorical situations they will face in ever-evolving workplaces. This chapter argues that professional writing students can develop transferable stylistic fluency by engaging style in those rhetorical spaces where science and writing interact. However, using science to teach style requires reimagining how science can fit into writing classes.

When science and writing meet in teaching spaces, the pairing tends to be stylistically monochromatic. Writing courses for future or working scientists focus on technical genres and the conventions of scientific discourse. Writing-intensive science courses also focus on formal stylistic conventions, whether of school genres (e.g., lab reports for canned experiments) or documents supporting novel research (e.g., reports and proposals). Science journalism courses focus on styles of popular accommodation—news reporting, the "gee whiz" style, etc. Finally, science-themed composition classes use science topics when teaching students about general "academic discourse," but those students rarely read or write scientific language (Moscovitz & Kellogg, 2005, p. 311). In short, approaches to science and writing tend to fall on either side of a line between "scientific writing" (or "writing science") and "science writing" (or "writing about science").[2]

I do not catalog these approaches to criticize them. Having taught science-themed sections of first-year composition as well as scientific-writing courses for both fledgling scientists at universities and scientists in industry, I can anecdotally confirm that specific stylistic foci are often required by programmatic mandates or pedagogical objectives. However, some courses and some students require polychromatic approaches to science and style.

Rhetorical situations involving scientific content demand stylistic flexibility. When writing about science, a communication professional might read and write prose in technical, explanatory, and wonder-inducing styles. As a consultant and researcher, I've designed curricula for pharmaceutical companies wanting stylistically consistent reports; I've been tasked with revising grant proposals to make them more compelling; I've created marketing materials for research institutions demanding "punchy," precise prose; and I've written histories of scientific discoveries to support my research on the rhetoric of science. Each of these situations has distinct constraints demanding an adaptable proficiency with prose style. Although most professional-writing students will not choose careers engaging science, they all can benefit from working with its demanding discourses in the context of a course. Moreover, science offers pedagogical benefits.

Science is an ideal conduit for teaching style for three reasons. First, the styles of science communication have been well documented by rhetorical theorists; this foundational work provides conceptual frameworks that support effective teaching. Second, rhetorical situations involving science are stylistically complex. Although discourses of science seem to sort into clear categories of prose style (e.g., technical, explanatory, entertaining), these categories are highly variable (e.g., the "scientific" register differs from field to field and from journal to journal). Therefore, scientific topics are ideal for teaching students how to assess and engage variation within marked styles. Third, scientific discourse is difficult and "strange" for many students—even students in scientific fields. Contrary to conventional wisdom, this strangeness is manageable and advantageous.[3] By reading, writing, and writing about scientific prose, students engage unfamiliar discourse, which encourages them to apply newly learned strategies.

The course described in this chapter capitalizes on the robust base of rhetoric-of-science scholarship, the consistency and variability of the styles of science discourses, and the beneficial difficulty of scientific prose. After explaining the rationale for the course, I summarize its projects and activities and document the merits of specific approaches with student-evaluation comments. Although this course is designed as an upper-level elective, its assignments and strategies might be productive in other contexts; course materials are reproduced in an appendix.

FROM THE RHETORIC OF SCIENCE TO A PEDAGOGY OF STYLE

Our understanding of the macro- and micro-level rhetoric performed in both the genres written for scientists and the various genres "translating" science for non-experts has grown dramatically over the past few decades. Pioneering studies by rhetoricians (e.g., Bazerman; Gross), sociologists (e.g., Latour & Woolgar; Myers), and linguists (e.g., Halliday; Swales) document the historical development, epistemological orientations, and contemporary conventions of technical scientific prose. Theorists have also explicated the rhetorical features of popularizations (e.g., Fahnestock), textbooks (e.g., Martin), and press releases (e.g., Graube et al.).

Although this corpus enhanced our understanding of the discursive activities pervading and surrounding scientific activity, some scholars argue that the relationship between this knowledge and composition curricula is vexed. According to Zerbe, subfields of rhetoric and composition engage science in partial and problematic ways:

> [E]ven when science becomes an area of interest … rhetoric and composition does not engage science head-on: either scientific discourse itself is ignored in favor of texts that are merely about science, (as is the case with composition and technical communication), or scientific discourse is analyzed but issues of pedagogy, literacy, and culture are disregarded (as is the case with the rhetoric of science). (2007, p. 50)

My course attempts to resolve the "silo" problems Zerbe identifies. It uses the machinery of the rhetoric of science to support a sequence of activities through which students engage—at a professional level—the practical problems of reading and producing both scientific texts and accommodations of science.

Inspired by Fahnestock's observations on the rhetorical distinctions between scientific communication and accommodations of science, my course is structured by the tripartite division of Aristotelian genres (1998, pp. 332-346). It contains a module on technical prose (forensic discourse), a module on writing about science for decision makers (deliberative discourse), and a module on popularizing science (epideictic discourse).[4] In each, students apply rhetorical theory to assess stylistic variety and to produce appropriate prose for stylistically distinct situations.

Module 1: The Technical Prose Module

In the technical prose module, students learn to assess unfamiliar styles, they learn to recognize features and "problems" of scientific prose, and they practice editing it. The module's major project asks students to comment on research reports by graduate students studying educational psychology. A colleague in that field invites her students to provide papers they plan to revise for publication. These documents are rhetorically flawed; some contain errors associated with learning English as a second language. My students analyze the papers, edit them to conform to a specific journal's style, and compose letters to the authors that explain corrections and recommend more substantive rhetorical revisions.

Published text: "Dam Safety: Problems with Metal Materials"	**Text after "plain language" revisions**
Corrosion is a common problem for spillway conduits and other metal appurtenances. Corrosion is the deterioration or breakdown of metal because of a reaction with its environment. Exposure to moisture, acidic conditions, or salt will accelerate the corrosion process. Acid runoff from strip-mined areas will cause rapid corrosion of metal conduits. In these areas, conduits made of less corrodible materials such as concrete or plastic should be used. Soil types also factor into the amount of corrosion. Clayey soils can be more corrosive than sandy soils since they are poorly drained and poorly aerated. Silts are somewhere in between clays and sands. Some examples of metal conduits include ductile iron, smooth steel, and corrugated metal. Corrugated metal pipe is not recommended for use in dams since the service life for corrugated metal is only 25 to 30 years, whereas the life expectancy for dams is much longer. In areas of acidic water, the service life can be much less. Therefore, corrugated metal spillway conduits typically need to be repaired or replaced early in the dam's design life, which can be very expensive.	This document explains how to prevent and repair safety problems for dams with metal parts. **How can metal parts cause safety problems?** Metal parts create safety problems when they fail. For example, a compromised spillway conduit can lead to the complete collapse of a dam. **Which metal parts are potential safety risks?** Metal dam parts posing safety risks include spillway conduits made of iron, smooth steel, or corrugated metal. They also include other appurtenances, such as drain valves and sluice gates. All metal parts can be damaged by ***corrosion***. **What is corrosion and what causes it?** Corrosion occurs when metal deteriorates because of a reaction with the environment. Environmental factors that accelerate corrosion include exposure to moisture, salt, or acidic conditions.

Figure 1. Example of revising according to the Federal Plain Language Guidelines produced by the Plain Language Action and Information Network (PLAIN). The source text is a fact sheet authored by the Ohio State Department of Natural Resources. To save space, some topics in the "before" column are not represented in the "revised" column. Although plain-language edits emphasize concision, beneficial design changes (e.g., headings and generous spacing) often increase document length.

To prepare for this assignment, students study rhetorical features of scientific articles, including stylistic features. We discuss grammatical "problems" associated with technical scientific prose, stylistic issues related to writing about numbers, and traditional ESL "trouble spots."[5] Students also learn to assess variation in technical styles through a quantitative norming activity inspired by Leech and Short's work on stylistic norms and Corbett's style exercises from *Classical Rhetoric for the Modern Student* (1990, pp. 404-421).

In the norming activity, students determine the discursive norms of educational psychology journals by coding and counting instances of specific features of scientific prose, such as voice preferences, pronoun use, and the Swalesian structures of introductions.[6] They also identify other features, such as average sentence length, passage length, and information about citations. After accounting for these features in a small set of articles, students use their data to develop style guidelines for their editing project. For example, if quantitative analysis revealed a plethora of personal pronouns—anomalies for "traditional" scientific language—then students could confidently advise their editorial clients that personal pronouns are appropriate. Similarly, if each article contextualizes its research by articulating how it "continues a tradition," then students have data to justify revisions to their clients' introductions. Although this exercise focuses on style in the discourse communities of educational psychology, quantitative norming is a useful tool for any situation in which "outsiders" approach unfamiliar and difficult styles.

Compared to other fields, educational psychology is relatively accessible, but its discourse is initially challenging for students. Once we discuss terms for the features of scientific discourse, most students do reasonably well in diagnosing problems in drafts. For example, Halliday's list of "grammatical problems" in scientific English coupled with Gopen and Swan's discussion of cohesion helps students determine if sentences are confusing because of syntactic, semantic, or pragmatic problems.[7] Once equipped with functional terminologies, students approach this unfamiliar language with greater confidence.

Although difficult, the technical editing project is a crucial first step. Editing for scientific style makes students better readers of technical prose, and they use these reading skills when accommodating scientific texts for other audiences. Student evaluations confirm the importance of the project in the assignment sequence.

Many students mention that the first module was their least favorite, but they appreciated its role. For example, one student wrote "I liked the last [project] the best, but I learned the most from the first one." Another recognized it as a necessary challenge: "Personally, I had the most trouble with the first assignment, but I think it could be argued that it was simply a necessary struggle in learning how to write about science." Yet another student explained how the first module increased scientific literacy: "We started with the hardest assignment first, which taught me how to read science." Indeed, the ability to read difficult technical prose is essential both for other course projects and for science writing generally.

Module 2: The Deliberative Prose Module

In the second module, students learn to describe science for decision makers, and they practice writing both in the "plain language" style and in a more energetic science-marketing style. They produce two related documents: a memo for a legislative official and a marketing brochure describing the same research. In completing both projects, students translate material from a scientific style into a plain style and from a plain style into a more ornate style.

Plain styles have a long and complex history in the rhetorical tradition and in contemporary culture. (See Kurlinkus and Bacon, respectively, in this volume.) Certainly, composition teachers must be wary of venerating some version of the "plain style" as the ultimate or primary goal of writing courses. Nonetheless, plain styles offer both rhetorical and pedagogical affordances. Sometimes, a plain style is the right tool for a task; it can also help students to notice differences between styles. For example, students can easily recognize the differences between scientific prose and the "plain language" style.

What I describe as the "plain language" style is the style advocated for in the *Federal Plain Language Guidelines,* a document produced to help Federal employees produce more accessible documents. This plain style does stress writing precise and concise sentences in audience-appropriate vocabulary, but it also emphasizes the importance of rhetorical arrangement and good document design. My students apply these principles in their legislative memo assignment.

In the memo assignment (a.k.a. "Defending Your Earmark"), each student is assigned an article by an OSU professor and asked to imagine that earmarked funding for the project has been scrutinized publically. The earmark's legislative sponsors need "plain language" summaries they can use to generate talking points to support the research. To prepare the students for science in plain language, we first discuss occasions where plain language descriptions are necessary. Specifically, we read case studies describing ethical, administrative, and political issues that arise when science enters deliberative spaces.[8] The students also practice translating technical texts into "plain language" by revising overly technical fact sheets distributed by a state agency. Figure 1 presents part of one of these sheets—a document on dam safety. The published text (left column) meets one prescription of the *Federal Plain Language Guidelines*: "use short sentences." However, it also suffers many of the problems that students must learn to recognize when revising for "plain language." The revised text (right column) reflects "plain language" advice for audience (e.g., "identify and write your audience"), structure (e.g., "organize for the reader's needs," "use lots of headings"), paragraphing (e.g., "cover only one topic in each paragraph"), and grammar (e.g., "prefer the active voice," "don't turn verbs into nouns"). Typically, students do well in revising for sentence length and voice, but they struggle with revising nominalized actions and organization. The revision exercise gives me an opportunity to comment on students' facility with these skills before they develop their memos.

In the second graded assignment for Module Two (the science marketing brochure), students work in groups to create documents about interdisciplinary research areas (e.g., music cognition) that the University's Office of Research could use in its development activities. The groups write about the research described in the "Defending Your Earmark" memos, but they must transform four one-page plain-language documents into two and a half pages of exciting prose.

This assignment's rhetorical situation mimics a project I consulted on for a different institution. A program executive wanted a library of one-page "abstracts" to take to meetings with agency officials, foundation executives, legislative directors, or other decision makers needing succinct but inspiring summaries of the institution's capabilities. Each abstract was to describe an emerging area of interdisciplinary research (such as nanotechnology) and to demonstrate the institution's expertise in that area by summarizing the research agendas of several scientists. Although described as "technical abstracts," the promotional purpose of the documents demanded a promotional style. Indeed, the initial efforts of my co-consultants were sent back for revisions because they "read like boring magazine articles" and "were not 'punchy' enough."

To prepare students for the brochure assignment, we discuss strategies for describing processes (e.g., Johnson's nested "black box" technique [134-135]), tactics of definition (categorical, partition, example, etc.), and tools for controlling sentence rhythm through alliteration, parallelism, and various types of phrasal modification. Students then practice developing compressed, evocative descriptions by producing profiles of rocks displayed in the University's geology museum.

The "writing about rocks" exercise begins with physical descriptions. The class visits the museum, and each student gathers details about the appearance of a rock. After drafting a description at the site, they return to the classroom and research the chemistry, the formation, and the historical, cultural, or industrial significance of the rock. They then revise their initial descriptions into profiles appropriate for an institutional newsletter.

The process of describing the visible features of the rocks leads students to generate evocative similes quickly; for example, "Dioptase is rough-looking, like sparkly green dried-out sea coral or a mass of green candy Pop Rocks." This practice with physical comparisons ties into deeper discussions of other figures of comparison, such as analogy and metaphor.[9]

Ken Baake's *Metaphor and Knowledge: The Challenges of Writing Science* offers precise, productive descriptions of how metaphors work, how they work in science, and which other figures of comparison offer alternatives to metaphor (2003, pp. 62-78). Such theorized descriptions offer a vital grounding in the figures of comparison.

Figures of comparison are essential tools for science writers because these authors often describe unfamiliar objects. For example, in the following passage, Stacey Burling uses both simile and metaphor to describe images of a brain destroyed by Alzheimer's disease:

> What struck [the Alzheimer's researcher] right away was what was not there. Slides from a normal brain would be solid pink. Many of these were dappled with white spots that made them look like slices of baby Swiss or leaves eaten down to the veins. The white holes were the abandoned homes of dead cells. (2007, p. 118)

After discussing the uses of simple figurative comparisons, we discuss how these figures can introduce ambiguities or create inaccurate associations. For example, we discuss a press release whose metaphoric title—"A Dinosaur Dance Floor"—originated in comments by a paleontologist when she discovered a site containing hundreds of overlapping dinosaur tracks from multiple species:

> Get out there and try stepping in their footsteps, and you feel like you are playing the game 'Dance Dance Revolution' that teenagers dance on," says Marjorie Chan, professor and chair of geology and geophysics at the University of Utah. "This kind of reminded me of that—a dinosaur dance floor—because there are so many tracks and a variety of different tracks."
>
> "There must have been more than one kind of dinosaur there," she adds. "It was a place that attracted a crowd, kind of like a dance floor."

In discussing the "dinosaur dance floor," students tease out the implications of the analogy. Clearly, mappings between the domains of human and dinosaur activity were at work as Chan thought about the site, and the phrase "dinosaur dance floor" is certainly evocative. However, "dance floor" might generate images of behavior unlikely to have occurred at the site; i.e., the dinosaurs were not actually *dancing* around the watering hole that attracted them. Also, as some students have noted, dancing often has romantic implications, which may or may not pertain to this situation.

Although an imprecise figurative description of dinosaur behavior might not represent a major ethical concern, the example helps to transition the discussion to cases where imprecise metaphors could have greater consequences. Accompanying a discussion of comparative figures with Ceccarelli's study on mixed metaphors in descriptions of genomic science helps students understand the stakes of using metaphoric language that is both productive and partial. We continue to discuss the benefits and ethical implications of figural language in the third module on popularizations of science.

Student comments on open-ended prompts often focus on two aspects of the second module: writing in groups and practicing concise description. Although many students dislike writing in groups—and vent that frustration in evaluations—it is an important skill to practice. And some students found the team-developed brochure to be the most useful assignment. According to one, "The group brochure assignment was the most helpful because it got us working in an interdisciplinary fashion." Other students have appreciated the scaffolding assignments for this module. For example, one student wrote, "The [activities] that taught me the most about concision while still being descriptive were the writing about rocks and instructions assignments."

Module 3: Epideictic Popularizations of Science

In the third module, students produce popularizations of scientific topics. Each student must choose a publication venue and assess the typical stylistic features of its articles. After locating story ideas and assessing potential venues, students prepare "pitch" proposals, which I must approve before they write their stories.

To prepare for this assignment, we discuss a range of popular accommodation styles—polemical essays, "gee whiz" science writing, health writing, broadcast styles, and science on the Web. Students also practice stylistic assessment by comparing many months' worth of science features from our local paper—*The Columbus Dispatch*. When examining all of these examples, we discuss the rhetorical features of popular science, tactics for creating compelling introductions, narrative structure, aspects of explanatory and contextualizing visuals, and rhetorical figures beyond metaphors and similes. Learning about rhetorical figures is especially important because these devices help students gain control over style at the phrase and sentence level.

An upper-division science-writing course is an ideal place to teach students about figural language because of the consistency with which rhetorical figures appear in science communication. As Fahnestock has shown, rhetorical figures function as inventional resources in primary science communication (*Rhetorical Figures in Science*), and figural patterns persist when science is translated for non-experts ("Preserving the Figure"). Moreover, popular science articles provide clear and provocative examples of a host of rhetorical figures.

In my class, we spend half a session discussing the figural resources deployed in just the titles of *Dispatch* science columns. These titles serve as examples that help students learn to identify both specific figures as well as broader patterns of figuration in a specific publication. For example, our discussions have revealed that *Dispatch* authors tend to use titles with alliterative phrasing (e.g., "Aid, Abet, Achoo," "A Mollusk Mystery," "Royal Research"), rhetorical questions (e.g., "Have You Seen This Frog?";"Can Animals Be Gay?"), and various substitutions involving movie titles and other cultural allusions (e.g., "When Silkworm Met Spider," "Magma P.I."). Less frequently deployed figures include antitheses (e.g., "Shrinking Glaciers, Rising Oceans"), analogies (e.g., "Toxic Soup"), and even rhymes forced through intentional error (e.g., "Boxes of Rockses"). (Additional examples are available online via the *Dispatch's* "Science Pages" archives.) For their final projects, some students choose to write *Dispatch*-style pieces, and they tend to appropriate the figural markings of the style effectively. For example, a student paper about the rapid shrinking and projected demise of the star Betelgeuse was punningly titled "The Life and Death of a Super Star."

Practicing with rhetorical figures gives students more than strategies for generating clever titles. For example, figures used in creating and managing lists are important sentence- and paragraph-level resources. By discussing and experimenting with asyndeton and polysyndeton along with incrementum, gradatio, and lists seeming to lack any trajectory, students learn about the conceptual and rhythmic consequences of listing. For example, in the following sentence describing an Alzheimer's patient, Stacey Burling controls sentence rhythm through nested lists, parallelism, and conjunction:

> Here was the essence of a man who had gone to Yale, loved a woman, fathered six children, loved ice cream and Mozart and e. e. cummings, favored questions over answers and change over complacency, hated camping, loathed golf, and,

> over the last 20 years, had slowly lost the capacity to understand any of it. (2007, p. 106)

Similarly, Matthew Chapman's polemical account of the *Kitzmiller v. Dover Area School District* case is a rich source for rhetorical lists. In describing stakeholders in this debate over teaching Intelligent Design, the author often deploys figurally-managed series. For example, the following polysyndetonic list emphasizes why Dover's curriculum-committee chair was unqualified to make curricular decisions: "The chair of the curriculum committee was Bill Buckingham, an ex-cop and corrections officer and self-confessed OxyContin addict" (Chapman, 2007, p. 160). As the module progresses, we move from identifying such stylistic devices to imitation and production.

The popularization assignment offers productive opportunities for imitating strong styles through short exercises and more elaborate activities. In one exercise, students identify noteworthy passages from our reading and use them as structural models for their own paragraphs. Longer modeling exercises include an in-class exercise in which students draft seven different introductions in thirty-five minutes. This activity generates much useful material, and student comments suggest that the exercise is productive. For example, one student mentioned that "the multiple introduction activity was particularly effective for me; it really helped my project along." Many students recounted similar experiences. Both of these modeling exercises are reproduced in the appendix.

Overall, student comments about the third module have been extremely positive. Students appreciate getting to choose the scientific topics they write about. They also appreciate how earlier assignments build up to the popularization article. One student noted, "The third assignment was the most exciting, but all of the assignments played a role in helping prepare for the final module."

CONCLUSION

In "Science Communication in the First-Year Writing Course," Moscovitz and Kellogg argue that scientific documents—what they call "primary science communication" or PSC—can be included successfully as readings in FYC courses. After making the case for the pedagogical value of PSC in first-year curricula, they address four counterarguments: 1) Including PSC overspecializes the composition classroom and emphasizes skills that might not transfer to other contexts, such as humanities courses; 2) PSC resists standardized programmatic frameworks—the rhetorical vocabularies grounding most FYC curricula; 3)

PSC is just too difficult to read; and 4) PSC readings will not interest students as much as readings from popular culture or humanities fields (2005, pp. 311—319). Moscovitz and Kellogg convincingly refute each argument; in concluding this chapter, I repurpose their refutations to reinforce the claim that an upper-level course engaging scientific discourse is an ideal site for teaching style.

First, transfer is a problem for any course, but good teachers can use specialized content to teach transferable skills. Although Moscovitz and Kellogg are concerned with the transferability of *reading* scientific discourse, this argument is also valid for *writing* it. Writing (about) scientific discourse provides students with opportunities to practice strategies—such as quantitative norming and structural imitation—which they can use when approaching any style. Moreover, by producing prose for diverse, stylistically distinct purposes, students are better prepared for the diverse communication tasks they will tackle in future positions. Finally, students themselves recognize that the skills they learned while engaging science and style are both specific and transferable. For example, one student mentioned that "Plain language style is useful in the humanities as well as scientific disciplines." Another noted, "I never really write much about science, so [the course] helped me branch out; it also taught me valuable non-fiction [writing] skills."

Second, rhetorical theory is robust enough to handle science. Rhetoricians have spent decades analyzing scientific rhetorical situations, and their projects are easily adapted for style-centered composition courses. Aristotelian genre categories and rhetorical figures are but two of the resources from rhetorical theory that help students understand style at the macro- and micro-scale. Terms typically used in FYC—such as ethos, pathos, and logos—are easily extended to discussions of both scientific writing and popularizations of science. For example, Prelli's accessible discussion of scientific ethos demonstrates how this familiar concept works in scientific situations (1997, p. 87-104).

Once equipped with enhanced rhetorical vocabularies, students can approach scientific discourse with confidence, and they recognize the power of these conceptual systems. When asked to describe how the course made students better writers, one student wrote that his or her writing skills had been improved by "the rhetorical tools I learned, as well as learning about problems like lexical density and syntactic ambiguity." Although recalling sophisticated stylistic vocabulary in a course evaluation does not demonstrate stylistic proficiency, it does indicate that this student gained a more nuanced understanding of issues affecting prose style.

Third, the difficulty of scientific discourse is overstated; difficult texts are good for teaching. Both Moscovitz and Kellogg and Michael Zerbe note that "impossible" scientific jargon is no more difficult than other advanced vocabularies we expect students to learn and use. For Zerbe, even the "language" of statistics can be productively encountered in composition classrooms through rhetorical vocabularies: "Statistics are essentially equivalent to Toulminian warrants in a text" (2007, p. 49). Indeed, I have found that Toulmin's framework helps students approach the rhetoric of numbers. Material from number-minded style guides (e.g., Miller's *Chicago Guide to Writing about Numbers*) can also help students compose texts engaging statistical concepts.

In short, students can learn to approach and use strange styles. Scaffolding assignments provide students with the tools and the practice they need to engage difficult texts in longer assignments. Evaluation comments suggest that students appreciate such sequencing. One student noted, "The short assignments helped pave the way for the more difficult projects." Another noted that scaffolding assignments made the larger assignments "less daunting." Moreover, students see the value in working with difficult discourse. One student commented, "The course pushed me to write about the unfamiliar."

Finally, students *are* interested in science. According to Moscovitz and Kellogg, many FYC students are highly interested in scientific topics, and we should capitalize on that interest (2005, p. 319). Similarly, many students take my course because they like science and want to write about it. Even those students who only take my class to satisfy an elective in our professional-writing minor tend to find the material on style engaging. By directing either their interests in science toward style or their interests in style toward science, the course helps students develop stylistic proficiencies, making them more effective communicators and more marketable professionals.

NOTES

1. I use an expansive definition of professional writing: Any workplace writing. Professional-writing courses include courses teaching general workplace literacies (such as "service" courses called "business writing" or "technical writing") and courses for students planning careers as technical writers, communications officers, etc.

2. Although some excellent scientific writing textbooks include material on accommodating science for non-experts, typically that material plays second fiddle to technical prose. For example, Penrose and Katz significantly expanded *Writing in the Sciences* for the third edition, but they did not expand the chapter on accommodation. Moreover, a chapter on procedures in the second edition was cut for the third, reducing the number of marked styles treated in the book. Thus, the third edition is even more focused on teaching research genres to upper-level science students—a purpose announced in its preface (2004, p. xiv). Similarly, good writing-about-science guides neglect technical

prose. For example, *A Field Guide for Science Writers*—required reading in my course—offers good advice on science journalism, including advice on how to read scientific articles when reporting on them (see Siegfried, 2006, pp. 11-17). However, it does not discuss producing or revising "technical" genres.

3. One argument against teaching scientific discourse to "general" composition students is that scientific prose is notoriously difficult for non-experts (Moscovitz & Kellogg, 2005, pp. 317-318). The "science is too hard" claim is refutable. Moscovitz and Kellogg argue that the difficulty is overstated, and they point to examples of accessible technical documents that FYC students can read (2005, p. 307). They also provide criteria for selecting accessible texts (2005, p. 322). Alternatively, the "difficulty problem" can be reframed as a pedagogical virtue. For Kelley and Bazerman, the "very strangeness" of scientific discourse "makes easier the task of explicitly introducing the genre conventions, social practices, and linguistic features of scientific texts" (as quoted in Moscovitz and Kellogg, 2005, p. 317).

4. In "Accommodating Science: The Rhetorical Life of Scientific Facts," Fahnestock uses classical and contemporary rhetorics to account for the metamorphoses that occur when writers adapt scientific content for popularizations. She demonstrates that genre shifts (from forensic to epideictic), stasis shifts (from fact to value), and modality shifts (from hedged claims to assertive or highly conjectural statements) are consistent transformations with clearly identifiable markings (1998, pp. 332- 346). Fahnestock does not address deliberative discourse in her article on epideictic popularizations; however, science does generate deliberative situations with specific stylistic demands.

5. Scientists whose first language is not English often hire editors; therefore, consultants should understand how to respond to ESL "errors." In my experience, however, the most significant problems of scientists who struggle with writing are rhetorical rather than grammatical—regardless of when they learned English.

6. Swales' work on research articles classifies consistent rhetorical moves used to contextualize research. In early work (1981), he marked these moves with just a numerical scheme: move 1) establish the topic and significance, move 2) review previous research, move 3) establish a gap in the research, and move 4) explain how the article fills the gap. Later (1990), Swales developed an ecological analogy for what he relabeled the Create a Research Space (CARS) model: move 1) identify the territory, move 2) identify a niche within the territory, move 3) occupy the niche. Each move is comprised of a set of variable, context-dependent steps (1990, pp. 140-143). Researchers have used both schemes when analyzing discursive norms.

7. Halliday identifies seven features contributing to the difficulty of scientific prose: interlocking definitions, technical taxonomies, special expressions, lexical density, syntactic ambiguity, grammatical metaphor, and semantic discontinuity (1993, p. 71). Gopen and Swan apply Joseph Williams's advice on style to scientific writing (1990, pp. 550-558).

8. These case studies have served as provocative readings: Schoenfeld's "The Press and NEPA," Scott's "Limiting Prevention, Limiting Topos," Wadell's "The Role of Pathos in the Decision-Making Process," and West's "How Not to Publicize Research."

9. For compelling arguments for teaching metaphor and analogy in technical communication courses, see Giles (2008) and Graves (2005).

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APPENDIX: COURSE MATERIALS ORGANIZED BY MODULE

This appendix contains assignment sheets and exercises. Some details, such as due dates and grading criteria, have been removed.

Module 1: Assessing and Revising Technical Scientific Prose

Science-writing professionals are often asked to revise articles, proposals, or other formal scientific documents written by and for experts even though they are not experts on the scientific content. Such tasks might seem difficult; however, research from the fields of rhetoric, writing studies, applied linguistics, and technical communication provides concepts and tools that help writers approach scientific texts successfully.

For this assignment, you will critique a draft of a research report written by an advanced graduate student in the field of educational psychology. The author plans to revise the paper for publication. Your assessment and revision of the document should guide the author in producing a more effective submission.

Objectives

In completing this assignment you will …

- Become familiar with communication practices in science
- Become familiar with conventions of scientific prose
- Practice analyzing variations in technical scientific prose
- Practice writing about technical scientific prose
- Practice revising technical scientific prose

Deliverables Description

You will (1) produce an editorial critique in the form of a letter and (2) produce an electronic revision of the author's draft.

We will discuss how to track your changes to the draft. You do not have to make the revised draft perfect, but you should demonstrate how the author could fix the most significant problems. Comments can include questions.

When planning, drafting, and revising the letter, consider the following items:

Audience

The audience is a graduate student in the field of educational psychology. This person is accustomed to reading documents in this field; however, he or she may not have any formal training in scientific writing. You may need to explain the rationale behind some of your comments and revisions.

Purpose

Your letter should provide a candid assessment of the author's draft and offer sound revision advice.

Your revision should identify problems in the text. Show how you fixed them or why you couldn't fix them.

Constraints

Your document must be at least four but no more than eight full pages, double-spaced. Maintain a courteous and professional tone; criticism should be constructive, and not nasty.

Components

Your critique should mention aspects of the text that are working well and draw attention to pressing problems. You might include comments on global rhetorical concerns (e.g., addressing the journal's audience appropriately, establishing exigence, etc.), genre concerns (e.g., using sources rhetorically, adhering to the IMRAD form, etc.), or stylistic concerns (e.g., tense, voice, hedging language, etc.).

Exercise 1: Article Analysis

For this exercise, you will analyze a research report to determine its structural and stylistic features. In the next exercise, the "journal analysis," you will work in groups to synthesize your findings. I will provide details for the "journal analysis" on another sheet.

Further Detail

Our clients for Assignment 1 are not sure which journals are right for their pieces. For example, the author of Document 1 is not sure if *The Journal of Experimental Education* or *Educational and Psychological Measurement* is the right venue.

To determine the best venue and to guide revision, we need to gather information from articles in these journals. This data will help us determine the rhetorical norms of the publication.

To distribute data collection, I've created groups based on the documents you were assigned for Assignment 1. Each group will work on a different journal; each member should analyze an article from a different issue of the journal. Choose issues from the last two years.

Getting Started

Follow the steps described below. Record your findings. Bring an electronic copy of your data DD/MM.

Steps

To complete the article analysis, complete the following steps:

1. Confer with your group; each person should select a different issue of the journal.
2. Select an article from your issue. The article should be an IMRAD article, NOT a literature review or letter. If you are unsure if the article is appropriate, ask me.
3. Title and abstract.
   How long is the title?
   How specific is the title?
   How many sentences are in the abstract?
   Tip: Use the "word count" tool in Word. You can copy and paste sections of text from Acrobat to Word.
4. Introduction.
   Label segments of the introduction according to the "four moves" model.What is the sequence of moves?

Label segments of the introduction according to the CARS "moves and steps" model. Which step does the author use to "establish a niche" for his or her work?

How long is the "literature review" section of the introduction? (word count)

Tip: There may not be a specific heading of "literature review," so pay close attention to where summarizing ends and "occupying the niche" begins.

How many citations are in the introduction?

Determine the tense of the main verb in each sentence. Tally each tense.

5. Methods.

    List this section's subheadings.

    Determine the voice for each main verb. How many are active? How many are passive?

6. Results.

    Are the results purely descriptive?

    Are other rhetorical activities occurring? Use Thompson's list (125) to label and count any other "moves."

    How many visuals are included?

    How many are graphs?

    How many are tables?

    How long are the table and figure captions? (word count)

7. Discussion.

    What strategies are used to qualify certainty? Keep a tally for modal auxiliaries, hedging verbs, and hedging adjectives and adverbs.

    Are limitations discussed? (Y/N)

    How many sentences are used to describe limitations?

8. Personal pronouns and self reference.

    How many times do "I" and "we" appear in the text?

    Are authors ever referred to as "the author" or "the authors?"

    Tip: Using the "find" feature in Word or Acrobat can expedite this step.

Exercise 2: Journal Analysis/Style Guide

For the previous exercise, you collected information about a journal article. In this exercise, you will synthesize your findings with those of your groupmates to create a style sheet for its journal.

You will have class time to collate/compare your data. I will provide an Excel file to organize your findings. Submit <u>one</u> document for your group.

Further Detail

Imagine you are a managing editor who assigns projects to consultants. To help your consultants "get a fix" on new projects quickly, you provide short overviews of publications. You need to create such an overview for your group's educational psychology journal.

Consider what your consultants need to know about the audience, style, and structure of research reports in this particular journal. For example, if your group did not find any first-person pronouns (I, we, etc.), you should create a tip about avoiding them.

Module 2: Summarizing Science for Decision Makers

In the first module, we examined how science is communicated to experts through the genres of research reports and proposals. In this module, you will study issues related to communicating science to non-expert decision makers by creating documents for two different audiences and two different purposes.

First, you will summarize a research project for a government official who needs to justify its funding. Second, you will work in groups to produce a brochure promoting the unique capabilities of a research group at OSU. In both documents, you will write about cognitive science.

Project Objectives

In completing this assignment you will …

- Practice writing about science for decision-making audiences
- Practice writing about complicated topics in short documents
- Practice writing explanatory materials to support political deliberation
- Practice writing marketing materials for an organization
- Practice developing definitions and descriptions
- Practice creating analogies and metaphors

Part I: Executive or Legislative Summary (a.k.a. "Defending your Earmark")

Legislators and executives often need information about research to guide policy decisions. In other cases, they need summaries of research to support or oppose its funding.

Many scientists rely on government money. Sometimes money comes from grants, and sometimes it comes from congressional earmarks. In either case, officials are often held accountable for these expenditures.

When denouncing earmark abuse in 2008, John McCain pointed to a scientific example: "Three million to study the DNA of bears in Montana. Unbelievable." In an interview with Sarah Palin, ABC anchor Charles Gibson raised similar points about research funding in Alaska: "Governor, this year, [Alaska] requested $3.2 million for researching the genetics of harbor seals, [and] money to study the mating habits of crabs. Isn't that exactly the kind of thing that John McCain is objecting to?" In these cases, earmarks were supporting worthy research with practical benefits, but the projects were portrayed as wasteful.

In this assignment you will summarize a recent OSU research project for a public official and his or her staff. Imagine that the official supported an earmark for the project and must now justify the expenditure as valuable and necessary. This official needs information to respond to claims that the project squandered taxpayer money.

Deliverable Description

Audience

Your audience consists of elected officials and political staffers. These readers probably have limited knowledge of cognitive science.

Purpose

You need to provide a clear assessment of the project and its benefits. Your document should succinctly summarize the research project and explain why it deserved funding.

Constraints

Your readers are very busy. They need a short description, no longer than one single-spaced page. The memo should be written in "plain language" style.

Components

Include a description of the study for a non-expert audience. Then, explain how the research contributes to the advancement of science and/or how it will lead to useful applications or social improvements.

Part II: Thematic Abstract/Marketing Brochure

Because scientific research can be extremely expensive, research universities like Ohio State provide resources to help faculty secure funding. The "business" of this research support is complex. Research officials often communicate directly with funding organizations to help define RFP requirements, to develop new support lines, or to coordinate the needs of funding organizations with those of researchers. These officials often need "marketing" literature to support their efforts.

For the second Module 2 project, you will work in groups to produce marketing materials for OSU's research development office. You will condense and energize your summaries from Part I to create a two-page research brochure.

The document must demonstrate the capabilities of OSU researchers in a specific area of cognitive science, and it must communicate the significance of this work in a descriptive and engaging style.

Deliverable Description

Audience and Purpose

Your audience is comprised of intelligent non-experts. Although these readers are not specialists, they regularly read accounts of scientific subjects accommodated to their non-expert level.

Your document will support marketing and development activities by succinctly describing the University's research capabilities. For example, a program officer might take it to meetings with agency officials, legislative directors, or other decision makers.

The document should convey that this research is exciting and important.

Constraints

The document must fit on two and a half pages (single spaced). The prose should be accurate but written in an engaging style that emphasizes the novelty and uniqueness of the research.

Components

Introduction: The introductory paragraphs should indicate a clear exigence for the research area. Describe the problems approached and solved. Demonstrate why the work is important. Who are the stakeholders? What is at stake?

Preview sentences: After the introduction, write a one- or two-sentence preview of each profile.

Profiles: Profile titles should be descriptive, accessible, and interesting. Each research profile should be composed of two to four short paragraphs. Establish exigence as soon as possible. Introduce the researcher. Describe the problems the researcher is solving. Define significant unfamiliar terms. Explain why the research is unique, amazing, a significant advancement, etc. Explain important applications. End each profile with the names and email addresses of the researchers.

Exercise 3: Writing in Plain Language

In this exercise you will practice editing for the "plain language" style by revising a policy document communicating scientific information.

1. Skim *The Federal Plain Language Guidelines* to remind yourself of the style's features.
2. Read the document called "Dam Safety."
3. Determine its primary audience; think about the needs of that audience.
4. Arrange the information into patterns that would help readers meet their needs.
5. Create new section headings to help readers find information.
6. Revise the text to conform to "plain language" style.
7. Submit your file to the dropbox.

Exercise 4: Writing about Rocks

In this exercise, you will practice developing definitions and descriptions by writing about a rock for an audience of museum supporters.

The Orton Geology Museum wants to include a "rock-of-the-month" feature in its newsletter. Your job is to create one of these features. The newsletter is not printed in color, and the museum has many supporters with vision disabilities, so the description must work without photographic support. This exercise has four parts.

Part 1: Field trip

Meet in the Orton Geology Museum on February X at XX:XX. We will only stay for 45 minutes; please arrive promptly. When we convene, I will give you the name of a display and a rock. Find the case; find your rock.

Collect information about your rock by answering these questions. (You may not be able to answer them all.)

a. What kind of rock is it?
b. Where is it found?
c. What are some of the other rocks in the same display?
d. Which minerals are contained in it?
e. What process formed it?
f. What color is it?
g. What shape is it?
h. What does its surface look like?
i. What does it look like?
j. What is interesting about it?

Before we leave the museum, write a paragraph describing the rock. Focus on its appearance. Write whatever comes to mind as you look at the rock from different angles.

Part 2: Research

Once we return to the classroom, research your rock. Answer the questions you could not answer at the museum and search for interesting factoids. Although Wikipedia is a place to start, you should also explore the geology sites listed on Carmen.

Part 3: Drafting descriptions

a. Write a few categorical definitions. For each, (1) identify a category to which this rock belongs and (2) explain its place within the category.
b. Revise your description from the museum; clarify the visual details.
c. Write a short paragraph describing the rock's formation process.
d. Create two or three different similes or metaphors to describe the rock. Which is more accurate? Which is more engaging?
e. Write a few sentences identifying why this rock is interesting. Is it remarkably old? Is its formation interesting? Does it have an unusual appearance? Does it have practical applications?

Part 4: Creating an exciting profile

Use the material from Part 3 to create a coherent profile of your rock. What would interest a non-expert reader?

Assignment 3: Writing about Science for Public Audiences

For the final project, you will write about science for a public audience. You will decide the topic, the purpose of the document, the characteristics of the audience, and the best communication channel to reach that audience.

Project Objectives

In completing this assignment you will …

- Practice writing about science for non-expert public audiences.
- Examine different styles used to accommodate science.
- Develop visual supports for textual accommodations of science.

Deliverable Description

Audience

You will choose an appropriate audience addressable through a specific communication channel. These channels could include newspapers, magazines, websites, broadcast outlets, museums, etc.

Purpose

Your document's purpose will depend on your audience, venue, and interest.

Constraints

We will discuss the constraints of your document in an individual conference. Your document must be long enough for the job.

Possibilities include …

a. Science journalism articles.
b. Descriptive guides of new treatment options for diseases.
c. Museum displays.
d. Extended profiles of a researcher or facility.
e. Documentary scripts.

Modeling Exercise

Find an interesting passage from today's reading. Point to it in your discussion-post title. E.g., "[Title], Page 2, Paragraph 2." Use the passage's sentence structure and style to develop a paragraph for your final project.

Start by separating clauses and phrases to get a sense of their arrangement and rhythm. For example …

> Dr. Stier's assistant picks up a scalpel
> and begins the autopsy
> by drawing an incision from the pubic bone to the sternum,
> where he bifurcates the incision,
> cutting toward each shoulder to form a Y.
>
> In the wake of the blade,
> skin and fat part with a delicate hiss and crackle.
>
> The assistant rolls the flesh back from the chest,
> then snips the ribs with a tool akin to pruning shears.
>
> The bones part with a wet crunch. (Perry, 2006)

Use the same structures to create your passage. For example …

> Dr. Buehl picks up a document and begins the grading by numbering

> the paragraphs, which he then evaluates, writing comments in the margins. Under the pencil, redundancy and important detail separate with muffled scratches. He circles the unnecessary passives, then underlines weak verbs. Patterns emerge in the smudged graphite.

Introduction Exercise

In this exercise you will practice writing various types of introductions. You will have <u>five</u> minutes to write each type. It is ok to think, but write while you think.

A. Write a three- or four-sentence CARS (Territory—Niche—Occupation) introduction.

> "The topic of this story is X. X is interesting because… These are the problems of X. [and/or] These are the new developments of X. These problems/developments are interesting because… In my document, I explain the significance/novelty of X by …. "

B. Write an introduction in the style of the brochures for Module 2. Imagine the research is a specialization of OSU or another institution.

C. Create a *Dispatch* introduction. First, describe the informative or context-setting graphic and choose a hook sentence that suits your topic.

Consider these examples:

> <u>Novel oddity:</u> [Toad pictures] "There are some things you don't send in the mail. That's why Terry Schwaner drove from Findlay to Phoenix to pick up a cooler filled with 400 frozen toad toes" (Dostal, 2009).

> <u>Description of application:</u> [3-D glasses picture and an info-graphic] "Battelle researchers are working with a Canadian company to create a camera that might change the way movies are made …" (Ferenchick, 2010).

> <u>Person focus:</u> [Pictures of creepy fish in jars and a picture of a scientist holding a shark.] "No roads lead to Tim Berra's favorite fishing spot on the Adelaide River. The OSU ichthyologist uses a small boat to get to the spot …." (Hunt, 2009).

> <u>Vivid scene:</u> [Bug pictures and maps] "The beetle was black with white spots and sported whip-like antennae longer than its inch-long body. It was clear to workers that the bug, found scurrying across the concrete

floor at the Downlite factory in Mason, Ohio, didn't belong there" (Hunt, 2009).

D. Describe a scene or process in vivid detail. If you described a scene in C, describe a different scene or process.

E. Tell your story as an author. Explain how you found this topic or describe events involved in writing about it. E.g., "Looking for the Lie."

F. Tell a story about a patient or other non-scientist. E.g., "Face Blind." (Fabricate a plausible story if you don't have a good example for your topic.)

G. Tell a researcher's story. E.g., "The Theory of Everything."