Developing an English for Academic Purposes Course for L2 Graduate Students in the Sciences

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Abstract: Graduate students face a fundamental change in identity when transitioning from undergraduate writers to graduate writers. In their new role as graduate writers and researchers, they must move from consuming knowledge to producing knowledge through their writing. Often, they must learn new genres of writing, new disciplinary conventions, and new rhetorical models. For non-native English speakers, these tasks are even more complex because of the advanced language skills required and the cultural differences in rhetorical models. This article explains teaching strategies for an interdisciplinary, graduate-level scientific writing course for non-native English speakers. For TESOL instructors who are accustomed to general undergraduate writing, this article will offer suggestions for scientific writing at the graduate level. For composition instructors who do not specialize in TESOL, this article provides ways of adapting graduate-level scientific writing conventions to an audience of international students.

Introduction

Graduate students form a distinct group of nascent scholars—neither established faculty nor novice undergraduates—who are becoming acculturated into their disciplines through the process of writing about their research. These students occupy a unique place in the academic community: they are transforming from students learning about a discipline to bona fide members contributing knowledge to that discipline (Abasi, Akbari, and Graves, 2006). Through their writing, they are shifting identity from learner to producer of research in order to make new knowledge claims in their field and to join the research community for that discipline. Making new knowledge claims involves an identity change in academic status as well as an epistemological change in relation to the field; graduate students must learn how to critique previous knowledge claims, articulate a gap or niche in the field, and argue that their research addresses this area by contributing new knowledge. From the sociocultural perspective, research writing for graduate students is not simply "writing up" results; rather, the writing process socializes these students into the norms of the discipline and begins to offer legitimacy as scholars in that discipline. Making new knowledge claims requires a sophisticated conceptual framework as well as an authoritative voice, both of which are challenging for emerging members of the discipline.

A growing body of literature articulates the need for specific graduate writing support, ranging from courses to writing groups (Polio and Shi, 2012; Kamler and Thomson, 2004; Rose and McClafferty, 2001). Previous studies highlight the benefits of these endeavors: Writing groups, for instance, help writers to navigate between the macro-level conceptual framework of the dissertation and micro-level revisions, develop peer review strategies, and articulate connections between different parts of the dissertation (Maher et al, 2008, p. 267). Similarly, group peer critique has been identified as the central pedagogy for improving writing

because groups provide a demonstration of the dialogic nature of writing and "a heightened sense of the processes and craft of writing when readers were not content specialists, [and] access to alternative non-discipline-specific perspectives" (Aitchison 2009, p. 909). Simply remaining accountable to a group or course, practicing writing on a regular basis, and having a support system in place contributes to productivity and confidence throughout the process (Maher et al, 2008; Ferguson, 2009).

Beyond the challenges faced by graduate writers in general, multilingual writers must overcome cultural differences in writing style; for instance, in American academic writing, the argumentative style emphasizes stating the thesis first and then supporting it rather than inductively circling the thesis and leaving the conclusion until the end (cf. Lakoff and Johnson, 1980). Compounding the difficulties of mastering argumentative frameworks, students also encounter new rhetorical/linguistic conventions for academic writing and disciplinary conventions for research writing in their area. Recent research has noted multilingual writers' difficulties in establishing new knowledge claims because these writers are doubly removed from the linguistic and social context in which authorial identity, voice, and academic discourse are established (Polio and Shi, 2012; Abasi, Akbari, and Graves, 2006). Abasi and Graves (2008) note that L2 students need extra development in order to implement writing conventions for making new knowledge claims, critiquing previous knowledge, and establishing an authoritative research identity because they are seeking to acquire the norms of American academia, the writing conventions of their field, and the general language ability to write original research articles. Graduate writing is far more technical than undergraduate writing; graduate students must master a larger body of discipline-specific vocabulary and employ that vocabulary in appropriate rhetorical patterns. Compared to undergraduate writing, graduate writing involves greater breadth and depth of mastery in disciplinary conventions, genre norms, and fundamental research knowledge. Graduate students are also writing for different audiences: conference panels, journal reviewers, dissertation committees, and other faculty. In order to write as a research peer, graduate students must learn to construct knowledge through their writing and do so convincingly for an audience of other researchers.

English for Academic Purposes courses provide one way to focus on rhetorical conventions for research writing by analyzing experts' examples, offering rhetorical strategies, and providing extensive feedback on students' drafts. EAP courses can provide a safe space for fledgling scholars to receive developmental feedback on writing and to explore conventions in their discipline without fear of the negative reaction they may receive from disciplinary advisors. EAP courses thus allow for linguistic experimentation and growth with coaching from composition experts who can articulate rhetorical conventions and help students gain writing confidence. Specifically, EAP courses for scientific writing at the graduate level are a unique undertaking because students come to the class with a much higher level of content knowledge than would undergraduates. The instructor for such a course cannot hope to be a content expert in the students' respective fields, nor is the instructor likely to be fully versed in rhetorical moves and genre conventions for each specific discipline. This type of EAP course, then, represents a unique challenge for the instructor, a challenge this paper begins to address. For EAP instructors who typically instruct undergraduates, this paper will provide strategies for adapting class activities for an audience of graduate, scientific writers. For composition instructors or writing tutors, this paper offers strategies for mentoring graduate writers in an interdisciplinary context and helping them adopt their disciplinary norms.

In this paper, I will describe a pilot writing course for multilingual graduate students in the sciences, Science Writing for Non-Native English Speakers. The development of this course arose because of my unique role at West Virginia University. Since 2009, I have created and directed professional development programs for graduate students across the university. Many of these programs have been based on core competencies for career success, as defined by the Council of Graduate Schools (cgsnet.org), Science Careers (sciencecareers.org), the Versatile PhD (versatilephd.com), and other disciplinary societies. Writing, one of these core competencies, became a concern because specific writing training on the graduate level is often scarce or lacking. Although WVU has a Writing Center that offers tutoring to both undergraduate and

graduate students, no graduate writing courses for research writing have existed on a university level. Interest for this type of course had been expressed at previous professional development events. Many of my programs have attracted a high percentage of international students, who often commented on the difficulty of improving their writing and completing drafts of their research papers. Based on this feedback and my background in English/composition, I was motivated to develop more writing resources for graduate students, and especially multilingual writers. This course was conducted in Fall 2012 and 2013 at West Virginia University, a Carnegie classification high-research university with approximately 5,100 master and doctoral students. The course was available to all students in the science disciplines, broadly defined. Scientific writing was chosen because the format for research papers usually follows consistent sections (introduction, methods, results, discussion) and the conventions of scientific writing are more uniform than for humanities writing. Fifteen students enrolled in the course each time, from the disciplines of chemistry, geology, geography, forestry, wood science, physics, psychology, chemical engineering, electrical engineering, human and community development, biology, political science, and public health. Students ranged from first-year master's students to third year doctoral students. The course met twice per week for fifty minutes each session in 2012 and seventy-five minutes for each session in 2013.

The course outline largely arose from the *Academic Writing for Graduate Students* text (Swales and Feak, 2004, 2012), which focuses on major skill sets in research writing, such as general-specific texts, data commentary, processes, problem-solution texts, and critiques. By the end of the semester, students practiced all the major components of creating an original research article or dissertation chapter. This essay will outline teaching strategies employed in the class, challenges associated with each strategy, and future directions for revising the course design.

Teaching Strategies

Strategy 1: Consultations

In order to make the course's writing assistance more personalized, I contracted with an ESL specialist, Iwona, to provide individual writing consultations with the students on a biweekly basis. This specialist had a wealth of experience teaching multilingual writers on the secondary school level and was eager to return to the university setting, where she had taught earlier in her career. She attended each class session, circulated among groups to offer feedback and suggestions, and addressed specific grammatical or rhetorical questions that had arisen during individual consultations in order to help the whole class think about a particular point. Iwona's own status as a multilingual writer also helped her to gain affinity with the students as she could relate their process of language learning with her own. Her perspective also enriched the course because of her exposure to different areas of research writing through her partner in the forestry department. During twenty-to-thirty minute individual meetings, students often talked about drafts of work they had produced for class, and on which Iwona or I had already commented. In meetings, then, Iwona could further interpret and expand on comments while helping students find solutions to their language questions. Some students also brought external work to appointments if they had other pieces of research papers or assignments due. Iwona was able to talk about general language conventions and often answered questions that the students were reluctant to pose at first to their advisors; in this way, her consultations created a safe place for students to articulate questions or ideas before meeting with their advisors.

Students in the course arrived with different levels of experience in graduate-level, research writing. Their level of knowledge about academic writing in general, scientific writing, genre expectations (e.g., thesis format), and technical language influenced the types of questions they asked and their writing goals for the semester. Students who had just begun a Master's program were often struggling with common L2 writing issues such as basic sentence structure and were not immediately ready to address more complex issues,

such as synthesizing previous research to make a knowledge claim. For more advanced doctoral students, the course represented an opportunity to refine their language skills within the specific genres of their discipline; for instance, some students were completing dissertations and wanted specific help in framing their argument or achieving clarity in extremely technical descriptions of methods, protocols, or results. Iwona noted differences in students' questions based on their level of experience. She states,

> In general, the more advanced students (the majority of them already at the end of their PhD process) were actually coming with specific questions and passages that they wanted to work on from the grammar and style standpoint. They would actually point to the specific sentence, phrase, or paragraph and ask my opinion on how it worked in the whole of the paper. […]The beginner PhD and master students were lost and overwhelmed with the format of the work and they were trying to figure out what they needed to do in what order. Working with them and following our textbook outline of how to build a research paper was a good exercise for them. (I. Cynk-Dahle, personal communication, March 20, 2013)

These comments align with the research on academic discourse communities in noting that students begin without a conceptual framework for developing a research paper and need to learn the large conventions of framing research questions before focusing on specific sentence-level revisions (Abasi, Akbari, and Graves, 2006). More advanced students seem to have internalized the overall structure of research writing and seek more help on specific passages. She also noted that her position as a tutor rather than a teacher allowed students to be more open with her about their questions. She observes,

> I think I was able not only to help with the writing process but I also in a few cases answered some interesting cultural questions concerning interacting with teachers in other classes. Many of the students we had last semester were new here. They do not feel comfortable asking questions and do not know the convention of interacting with the teachers. Since I was not a de facto teacher, I made the point to speak to them about some of the issues openly. Some of the students needed to go back to the lead teacher [in their department] and ask some specific questions to help them with their writing. (I. Cynk-Dahle, personal communication, March 20, 2013)

These comments reveal the difficulty of negotiating cultural expectations in a new academic system while simultaneously negotiating scholarly identity within the discipline. Multilingual students encounter the challenges of entering the American educational system, working with new professors, and completing complex writing assignments in a different language. For graduate students, their major advisor is often the center of the universe—mentor, judge, boss, teacher. In a research-driven program, the advisor essentially controls the student's fate by choosing or guiding the student's research question; supervising the student's research; deciding when the student is ready to defend the research; and by approving the final piece of writing. Students often feel enormous pressure to please their advisors, and international students may feel even more pressure because their future in the United States depends on succeeding. For these reasons, the L2 instructor needs to coach the student in deciphering the disciplinary norms for research writing as well as composing questions to ask the advisor. The instructor may need to enter the role of co-learner to explore the rhetorical moves, organizational patterns, and jargon common to the disciplinary context.

Although the course did not specifically collaborate with content-area experts, Iwona and I were sometimes asked by students to interpret comments that advisors had written on students' work. This role of interpreter carried both advantages and disadvantages for instructors and students: while students benefited from having another source to triangulate information they were receiving, we instructors had to warily avoid making definitive judgments that might not align with the advisor's opinion. One option, as I will

discuss later, would be a cooperative model of teaching the course with a subject matter expert in a particular discipline.

Strategy 2: Templates

I selected two textbooks for the course, each of which provided a great deal of language scaffolding, both at the level of rhetorical moves and specific grammatical points. Since students often articulated their writing weaknesses in terms of grammar, it was important to acknowledge and spend time on grammar practice, as I will discuss in strategy 5. However, for the purposes of understanding the dialogic nature of academic writing and the idea that research must enter into a conversation within the field, it was equally important to establish frameworks for students to position their work. This process of positioning is an integral part of the shifting identity from learner to producer of knowledge; students in essence must begin to view themselves as peers with other researchers in their discipline and enter into the scholarly dialogue around a particular research area. Even more important, students need to articulate why their own research is unique or significant in relation to other work. This type of declaration requires several rhetorical moves in order to establish the claims of previous work, show a gap or unanswered question, and explain how their research addresses this gap. Both class texts aim to help students negotiate the rhetorical conventions necessary to join the academic dialogue. The first, *Academic Writing for Graduate Students*, (Swales and Feak, 2nd ed. 2004, 3rd ed. 2012), operates on the valuable "Creating a Research Space" (CaRS) model of framing research projects while offering specific rhetorical and grammatical solutions for writing tasks, including writing definitions, identifying a research problem, commenting on data, describing methods, and discussing results. (Swales and Feak, 2004, p. 244). The second, *They Say I Say: the Moves that Matter in Academic Writing,* 2nd edition (Graff and Birkenstein, 2010), is aimed primarily at undergraduates, but it is valuable for multilingual writers because it provides templates for agreeing, disagreeing, commenting on sources, and articulating an argument. Both texts offer a wealth of specific language strategies for framing a research argument and composing segments of that argument. The accessible tone and reading level of *They Say* made it an effective entry point for students to grasp the dialogic nature of academic writing even as they delved into more detailed explanations in the *Academic Writing* text.

During the course, I often employed templates from the texts or adapted my own templates in order to help the students practice rhetorical moves in class. We often began with simple templates that illustrated basic research moves, such as comparing and contrasting research findings from different articles or summarizing a group of findings in one sentence. These simple templates evolved into more complex exercises in which students were asked to extrapolate from the general template and find discipline-specific examples in peer-reviewed journal articles. Templates for research writing also differ widely across sections of the research paper; that is, a rhetorical move for the introduction does not resemble a rhetorical move for the methods or results sections. As we progressed through the course, we were building a corpus of grammatical and rhetorical patterns that corresponded to different sections within scientific research papers.

At the beginning of the course, some general templates for connecting past and current research allowed students to begin identifying their research niche. For instance, based on a problem/solution paragraph the students had revised, we used these templates to practice linking past research with present research.

- Experiments showing _____ and _____ have led scientists to propose _____.

- Because _____ does not account for _____, we instead chose _____ method.

- Our data support/challenge the work of Zhang by showing that _____. (adapted from Graff and Birkenstein, 2010)

As the course progressed, the rhetorical analyses and corresponding templates became more complex and discipline-specific, which required the students to become the primary experts in their own disciplines. Students were required to bring peer-reviewed journal articles and sample student theses/dissertations to class on a regular basis so that they could examine this writing in light of the structure we were discussing. I also designed class exercises to purposely ask students to examine writing both within and outside their own discipline in order to highlight the similarities and differences in language patterns. For instance, while working on methods sections of research papers, we examined a psychology paper about teen smoking (Wakschlag et al, 2011), a geochemistry paper about water contamination (Sharma and Baggett, 2011), and an electrical engineering paper about a medical device for artery correction (Avile-Montes et al, 2013). In each of these papers, we identified common grammatical patterns for methods, such as linked passives, participles, and linking phrases with time references. While we found some similarities in patterns—mini-templates of sorts—we also discussed differences across disciplines. For instance, the human subjects research spent significant time explaining how subjects were selected and how the interview protocol was developed and validated for the study. The geochemistry paper, which involved natural resources rather than humans, described the site locations and seasonal differences in detail. The electrical engineering paper differed significantly from the others in verb tense and active voice; the methods section was primarily written in active voice, present tense verbs rather than passive, past tense verbs, as many other disciplines employ. Learning these differences was crucial for students within these disciplines to see the type of information expected in the methods section, the depth of description, and the expectations for grammatical structures. Exploring disciplinary conventions was enlightening as a metacognitive exercise because students and instructors needed to step back and reflect on the patterns, contextualize them, and create a mental framework for understanding the disciplinary expectations.

Working with templates provides students with tangible, practical structures that help overcome initial language barriers when expressing research ideas. The basic templates can be easily adapted to different disciplines and allow students to insert ideas from their own research area. Templates help to break down the complexities of research writing into manageable chunks of argument while also reducing some of the writing fatigue that occurs when writing in another language. To encourage students to write drafts in English rather than writing in their first language and translating, templates provide an avenue for creating effective, grammatically-acceptable sentences.

The generalizability of templates is also their weakness; any one template may not match the typical disciplinary vocabulary or sentence structures employed in a particular journal. For this reason, students need to construct their own templates and examine work from their own disciplines to reach higher-level competency. The instructor acts as a guide to help students identify patterns and implement these patterns in their own writing while being aware that the students need to accept themselves as subject matter experts in the process. Students in the course often used templates when constructing their homework drafts; learning to manipulate these templates to match their writing needs was itself a valuable exercise in understanding rhetorical strategies and sentence forms.

Strategy 3: Textual Analysis of Research Writing

In order to help students understand the conventions of research writing in their disciplines, we spent extensive time analyzing excerpts of articles in class. For many exercises, I selected articles that aligned with one of the disciplines represented in the class: for instance, a public health article on the effects of coal mining in Appalachia or a geology article on mine runoff into watersheds. Students were also assigned to find articles and theses/dissertations in their own disciplines. Some homework assignments required them

to analyze a specific aspect of the text and present their findings in a small group during the following class. During class, our group composition varied, but most often students worked in interdisciplinary groups, which proved to be a great advantage for students explaining or commenting on disciplinary conventions in the chosen writing sample and from their own discipline. Explaining both the general content of a research article and the mode in which that research is presented provided the students an opportunity to step back from their own fields and speak about the norms that they had perceived in the writing. For instance, the psychology students were accustomed to working with qualitative research, in which the writers often have to describe their instrument and coding scheme in detail, while the biologists were accustomed to genomics-based research that emphasized the equipment and specific procedures that were conducted in the experiment.

Based on our topic at a given point, we would analyze the excerpts for specific rhetorical functions, such as how the writers identified their research problem, how they described figures, how they presented results, or how they cited previous research.

Example 1: Presenting limitations in previous research

Students analyzed the transitions (italics), "limitations" language (bold), and "future directions" language (underline) in a short passage to determine how the author critiqued previous research. We could then discuss how to introduce gaps in the field and ideas for future projects.

> Although long fire history data sets will be required to validate models and determine whether fire regimes have experienced a change of state, these data are difficult to collect, are limited in occurrence, and inferences are restricted by the spatial and temporal resolution of the data. As previously noted, few regions of the world maintain long observational records of past fire activity, and satellite records are currently too short to detect change. Climatic variability and human activities are also strong drivers of fire activity, therefore studies of anthropogenic climate change and fire must take these variables into account. While fire history data have the potential to address some of these challenges, inferences remain somewhat limited. (Hessl, 2011, p. 399)

Example 2: Describing figures.

When writing results sections, most disciplines incorporate tables, graphs, or figures to display the data concisely and provide a basis for description. At the graduate level, students need to be able to generate the data through research, create the figures, and cogently explain the figures to an academic audience. These explanations may involve a variety of rhetorical moves, including comparison statements, qualifying explanations, and direct vs. indirect references to figures (see Swales and Feak Unit 4, Data Commentary).

In a paper studying ocean temperature variation, we examined the language of comparison and contrast. For instance, the following sentences represent an example of comparison statements (italics), indirect reference to a figure (bold), and direct reference to a figure (underline). "The variance in SST *is greater* for Northwest Pacific ecoregions than in the Northeast Pacific (**Table S1**). The ecoregions *with the greatest variance* are the Yellow Sea and Sea of Japan, while those *with the least variance* are the Aleutian, Northern California, and Oregonian regions. The mean annual cycles in SST in the North Pacific ecoregions are shown in Figure 3" (Payne, Brown, Reusser, and Lee, 2012, p. 3).

In a computer engineering paper about wireless cellular networks on a commuter train, the graphs in the results section require a different kind of description to indicate the rate of increase or decrease. For this analysis, we focused on reporting verbs (bold), descriptive language (italics), and, and explanations [in brackets].

> Fig. 4 shows our field test results. Fig. 4a reveals processing delays for a D-router and proxy under different loading situations. As we can observe from the figure, the processing time increases linearly from 50 to 550 μs [when new sessions are added incrementally]. [Even though the heavily loaded one can take a longer time to handle a newly joined session], the process time, which is in the unit of microseconds, is nearly negligible [when they are compared with RTT] (usually in the magnitude of milliseconds). (Tso et al., 2013, p. 2214)

Using multiple sources from different disciplines showed the array of data commentary styles that may occur, and the students could then identify models in their own discipline.

Example 3: Reading abstracts.

Students read an "Editor's Choice" abstract from *Science* and answered these questions:

- What is the major research question or problem?
- What is the gap that this study fills?
- What is the novel finding in this study?

This exercise helped to present the CaRS model in a condensed space and to understand the importance of writing for different audiences; in this case, the abstract uses a football analogy to make the study relatable to a lay audience.

> Abstract excerpt from "A Strategic Defense":
>
> Just as in American football, during the immune response, the location of your defenders is key. One player out of line can make the difference between a sack or a touchdown, or in the case of the immune system, a localized versus systemic infection. How the immune system orchestrates this careful defense, however, is not well understood. (KLM, 2012, p. 17)

This introduction helped the students understand the use of an analogy for a complex scientific topic and the differences in writing for a specialized audience in the discipline versus a scientifically-literate layperson. The abstract continues, "Kasternmuller et al. now demonstrate that the organization of cells within the lymph nodes of mice is critical for preventing pathogen spread during the first few hours of an infection. Infecting bacteria drain to nearby lymph nodes, where they are immediately collected by a specially localized population of macrophages" (KLM, 2012, p. 17). Reading abstracts demonstrates that a significant scientific contribution can be condensed into a brief explanation if skillfully constructed. This brief genre essentially supplies students with a thumbnail sketch of an entire research dialogue in which new research fills a need or a gap within the discipline. By seeing the research space represented in such a brief format, students then could find these moves in longer research articles.

These exercises helped students understand rhetorical conventions in the Creating a Research Space model, and they gained strategies for positioning their own work. Textual analysis also helped to reveal differences in research writing between disciplines. For instance, some engineering papers do not follow the introduction-methods-results-discussion format if they are proposing an algorithm, system, protocol, or other model. In these types of papers, the sections generally follow a progression of explaining variables or aspects of the model in detail before presenting the results of running that model in a test or simulation. Explaining the model often appears similar to a mathematical proof in which variables and assumptions are systematically defined using present tense verbs. Contrasting this genre, research papers in many basic sciences rely on procedural methods sections with past tense verbs, and these methods are often quite short

in relation to the results or discussion. When students encountered these sub-genres of research writing, they then considered the specific norms within their discipline as they related to the larger enterprise of academic writing. Seeing differences helped to solidify their understanding of conventions within their own discipline. For instructors of these courses, the range and specificity of disciplinary writing strategies can be overwhelming, but this disadvantage can become an advantage in helping the students to articulate what they already know about their own disciplines and become the expert to explain these moves to the other students in the class.

Strategy 4: Peer Review

Students frequently came to class with short pieces of writing, making peer review a key component of class time. The process of peer review, learning to critique others' writing and provide constructive comments, is a central part of acquiring scholarly identity and becoming a competent academic writer (Aitchison, 2009, p. 906). Based on the *Academic Writing for Graduate Students* text, many of our writing assignments dealt with specific tasks in academic writing, such as creating definitions, forming problem/solution pairs, commenting on data, or describing a process. During peer review, then, we used the core components of that task in order to decide the elements of the critique. The following example illustrates a peer review exercise based on results sections.

Data Commentary Peer Review (all references to Swales and Feak, 2012):

- Identify the patterns of location statements (see pg. 309)
- Circle the reporting verbs (see pg. 150-151).
- Underline the comparisons or descriptive (see pg. 167-169).
- Write "P" over all prepositions of time (see pg. 183).
- Put brackets [ ] around examples of qualifying statements (see pg. 159-163).
- Put a star next to any explanations of problematic data (see pg. 174).

Peer review in our interdisciplinary setting offered students fresh perspectives on their own research projects because they needed to explain the project, as well as their own writing conventions, to others who were not in the field. The most productive discussions in the course occurred as students summarized their research questions or processes to others who were unfamiliar with the area. Students in different stages of research also benefited from interacting with peers because they could compare the research process in their disciplines: What does a dissertation prospectus look like? What kinds of data do you need to collect? What methods are appropriate and respected? Do you need to publish your dissertation study before you graduate? The instructor may not know the answers to all of these questions, but students can generate ideas and questions to return to their departments.

Peer reviews offered a layer of comments, different from instructors' comments, to augment the writers' perspective. Peer reviews often led to issues we could discuss as a whole group, such as common vocabulary from the field that can be used without citations, and the extent to which technical vocabulary can be paraphrased. These discussions revealed the intricacy of scientific writing and audience; within a sub-discipline it may be acceptable to repeat technical phrases or assume that the reader has the background knowledge to understand a common method. At the same time, demonstrating novelty remains the defining characteristic of publication, which may seem at odds with showing respect for others' work. The instructor's role is to facilitate these discussions and help students navigate through the many gray areas in creating research texts.

Strategy 5: Grammar Warm-Ups

Students appreciated the opportunity to review thorny grammatical issues, such as pronoun agreement, compound/complex sentences, run-on sentences, and verb tenses. I incorporated grammar warm-ups using common resources such as Diana Hacker's online grammar worksheets (www.dianahacker.com) and Dave's ESL Café (www.eslcafe.com). Including grammar exercises at the beginning of class helped the students transition into language-thinking mode, in which they were attuned to common language issues. Many grammatical constructs, such as prepositions and articles, require years of practice and "ear training" to implement because rules are often inadequate to explain their usage. When practicing specific elements, such as the construction of compound sentences with semi-colons versus coordinating conjunctions, students enhance their knowledge base so that instructors could reference these forms in future paper comments. Rather than trying to write out the grammatical rule, we could refer students back to the exercise as a reference for improving the sentence in question. To apply specific grammatical tasks to scientific writing, we incorporated grammar into our discussions of templates and rhetorical moves. Helpfully, the *Academic Writing* text incorporates grammar exercises as they apply to different rhetorical tasks. For instance, we practiced grammatical topics such as using linked passives to describe a process in the methods section, incorporating modal verbs as qualifying statements, implementing active versus passive voice for describing methods and reporting results, and changing verb tense for different sections of research papers. Students reviewed these grammatical structures and then analyzed them in research articles or individual writing for that day. They also practiced these structures in the context of the technical explanations needed for their research.

Strategy 6: Dialogue

Although this was a writing course, students benefited from *speaking* about their research to other graduate students across different disciplines. Throughout group exercises and whole-class discussions, they explained their research projects and responded to others' writing. The physical and mental work of public speaking reinforces language learning in a different way than the act of writing. Both are valuable for encouraging clear explanations of difficult research topics and contextualizing their research within the larger field. Even the act of asking questions during class and engaging in dialogue about writing conventions prompted students to create more complex language frameworks. In other words, dialogue promoted building connections and deepened understanding through extended explanation and elaboration.

Near the end of the semester, students were also asked to give a two-minute elevator speech about their research projects. They delivered these elevator speeches as a dialogue, in which another graduate student asked them follow-up questions about their projects. Coming at a point when students had great rapport with each other, this exercise showcased their increased ability to articulate their research niche. The exercise helped to confirm their changing identity from learner to producer of new knowledge. In addition, this elevator speech highlighted the need to differentiate technical communication from non-technical communication. With the increased national emphasis on communicating science to lay audiences, students must learn to communicate within their discipline and beyond it. The instructors and other students served as an important audience in this dialogue to reinforce the idea of academic community. Graduate students increasingly need to see themselves as subject matter experts and colleagues within the discipline while also becoming ambassadors to the larger public.

Discussion and Future Directions

In general, this course was successful in providing students with necessary feedback to make progress in their scientific writing and continue their academic journeys. One student commented, "Thank you so much for this email and also for great experiences that we shared in class. I made great (HUGE) progress

in my "writing process" development, although it's not looking like that. Before this semester, every time when I have to write something, and it is more then 5 sentences long I had headaches. Now it's much better situation. Probably, the reason for that is that you gave me confidence and also I know that there are lot of other people with same problems as mine. I just needed to "start", and this class literally push [sic] me into that. Now everything is much better" (Personal Communication, 7 December 2012).

To revise the course after the first attempt in 2012, Iwona and I implemented several specific changes in Fall 2013. To begin, the course moved from two credits to three credits, which allowed a change from 50-minute class period to 75-minute class period. This significant increase in class time provided more opportunity for in-class writing, student interaction, and writing exercises. More importantly, Iwona and I reorganized the course to focus each unit on a different section of the research paper (introduction, methods, results, discussion). We introduced the Creating a Research Space model (Swales and Feak, 2004) at the beginning of the semester as a way to frame the scientific writing process. In 2012, some students commented that they did not grasp the big picture until the latter stages of the semester when this model is introduced in the *Academic Writing* text. Rather than following the book linearly, we re-organized the readings so that students read the portion on each section of a research paper along with the chapters that described specific rhetorical tasks for that section. For example, we read the chapter on results sections along with the unit on data commentary in order to practice the strategies of data commentary within the context of writing results. This reorganization was a major change from the first iteration of the course in an attempt to connect the macro-level research sections with the micro-level rhetorical moves. Other instructors designing a similar course should consider how the course structure aligns with students' understanding of research writing. Providing specific rationale and explanations of the course structure along the way is important for students to build the mental framework for scientific writing. Students need to negotiate both the scaffolding of disciplinary and genre conventions as well as the intricate work of sentence structure and grammar within specific sections of a paper.

For instructors, teaching this kind of course involves humility: instructors cannot and will not be subject matter experts, nor can we pretend to fully understand students' research. This lack of understanding is sometimes frustrating, but it can also be advantageous. Asking students to explain their research allows them to practice doing so in a safe space. In their writing, they need to incorporate technical terms, methods, and data analysis appropriate to their disciplines, and the instructor usually cannot comment on the accuracy of these elements. The course then becomes a partnership in which the student contributes content knowledge and increasing awareness of disciplinary writing as the instructor coaches them on rhetorical models.   Forging   this   partnership   makes   the   course   work. For in-class activities, I have revised my lesson plans with several considerations: I ensured that we completed self-assessments more regularly so that students could direct their readers to focus their critique. Students also tended to form consistent groups for peer review. This continuity created rapport and a high comfort level for the students, but the contents of critiques were limited by the perspective of those group members. I now rotate peer review groups on a regular basis in order to provide different perspectives for the writers. Further, the longer class time provided more writing time to revise work in class based on peer reviewers' comments. Making immediate changes helps to consolidate the learning and improve the draft, thus allowing the student to turn in a revised draft at the end of class.

In order to foster long-term writing progress, in 2013, students developed a writing plan at the beginning of the semester to indicate the major project they would complete. Since students in the class were at different stages of their graduate work, having one static research paper assignment was not feasible. Rather, students worked on projects appropriate to their stage: literature reviews, journal articles, thesis prospectuses, and portions of their dissertations. Asking students to chart their writing goals created more continuity between assignments throughout the semester and their own projects. Many of their short writing tasks then contributed to the larger project in a more meaningful way.

Challenges arose in all aspects of the course in working with the various disciplines represented, yet the variety of disciplines also enriched the course greatly by offering a range of research projects and writing patterns to study. To work with this group of students, both Iwona and I analyzed journal articles in the students' disciplines in order to understand the conventions at a reasonable level. As the course progressed, we placed more responsibility on students to regularly analyze and report on these conventions in journal articles from their own disciplines to deepen their learning experience.

In 2013, I intentionally incorporated more activities related to discovering disciplinary norms and will continue to expand these activities. For instance, students in the course need to examine the citation practices and the functions of citations in their disciplines in order to understand how new knowledge claims are constructed (Dong, 1996). Research on L2 writers provides the groundwork for these activities. For instance, Chang and Schlepegrell (2011) explore the CaRS model to identify "expansive and contractive" rhetorical devices for identifying a research area and narrowing the niche. As they note, the social sciences place more importance on explicit interpretation of sources compared to the hard sciences (Chang and Schlepegrell, 2011, p. 143). Perhaps these differences in interpretation arise from the nature of the data; more qualitative data may call for more interpretation of results in order to relate them to the student's current study. By asking students to identify and practice these expansive and contractive rhetorical devices, they can see the specific means of narrowing the research niche within their target journals.

Lim (2012) also employs a cross-disciplinary comparison of specific language for indicating a research gap. In 2013, I asked the students to read his article on linguistic mechanisms (essentially, groups of templates) for indicating a gap (Lim 2012, p. 242), find the most common mechanisms in their discipline, and emulate those mechanisms. I will continue to strengthen the students' practice in incorporating citations to make new knowledge claims. Mansourizadeh and Ahmad (2011) have examined citation practices of novice and expert writers and have found that novice writers use citations in less complex ways (i.e., attributing previous knowledge) than the practices of expert writers (i.e., justifying findings or supporting methodology) (p. 158). These practices are complicated by the fact that hard and soft disciplines rely differently on integral vs. non-integral citations (whether the researcher is named in the text) (Mansourizadeh and Ahmad, 2011, p. 153). In 2013, the class spent more time analyzing literature reviews to articulate the purpose and method of citing sources in creating a research space.

Throughout the semester, the students in 2013 examined more models of social science writing and science writing in order to differentiate methods of interpreting previous research, identifying a research niche, and creating an argument for new knowledge. Students need to be coached to find these conventions and practice them in a structured environment (Abasi, Akbari, and Graves, 2006, p. 114). Asking the students to regularly analyze articles in their field helped them to develop templates, recognize common rhetorical moves in their discipline, and gain scientific literacy.

If this course were adapted for specific departments in the future, I would advise a co-teaching model in which a content specialist from the discipline team- teaches with a writing specialist who can elucidate the rhetorical conventions. Since content specialists have already been socialized into disciplinary norms, often without formal instruction, their ability to articulate or explain these norms may be limited (Abasi and Graves, 2008, p. 231). A co-teaching model provides greater content knowledge and discipline-focused writing projects alongside writing instruction targeted to that discipline's norms.

Although courses focused on English for Academic Purposes are one way to offer writing support to multilingual graduate students, other resources at the university also help to provide this scaffolding for graduate students in general. To increase attention to writing as a core competency for graduate students, I have partnered with the Writing Center to offer week-long dissertation boot camps open to any graduate student in the dissertation stage, and a faculty member is currently teaching a cross-disciplinary grant writing course as an introduction to that genre of writing. In fall 2013, my office also co-sponsored two graduate assistants from the Department of English to offer graduate writing consultations through the

Writing Center for the first time. All of these efforts increase the attention to graduate writing instruction as a whole and provide additional scaffolding for graduate writers' advancement. Initiatives such as the graduate writing tutors provide enhanced opportunities for multilingual writers to receive more intensive instruction, aside from taking the course or as a supplement to the course.

As emerging members of their disciplines, graduate students need specific writing instruction in how to articulate their research contribution to their field, and multilingual students benefit from additional training that combines the rhetoric of academic writing with specific language concerns. Students are transitioning from the role of learner to that of scholar, from internalizing previous work in the discipline to creating new knowledge claims in the discipline; these tasks require scaffolding to recognize and apply writing conventions. This science writing course for multilingual writers at West Virginia University provides one model that relies heavily on individual instruction, using templates, analyzing articles from students' fields, and writing frequently about students' own research. In further iterations, I hope to refine this model in order to provide even better assistance to aspiring researchers and collaborate with other institutions pursuing course-based or peer coaching models.

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