AC 2009-961: "IT'S NOT MY JOB TO TEACH THEM HOW TO WRITE": FACILITATING THE DISCIPLINARY RHETORICAL SOCIALIZATION OF INTERNATIONAL ESL GRADUATE ASSISTANTS IN THE SCIENCES AND ENGINEERING

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"It's not my job to teach them how to write": Facilitating the Disciplinary Rhetorical Socialization of International ESL Graduate Assistants in the Sciences and Engineering

Abstract

The purpose of this research was to determine the challenges faced by international ESL graduate assistants in the Sciences and Engineering in writing for their academic programs and professional positions (e.g., proposals, dissertations, journal articles, conference proceedings), as well as those faced by faculty in helping them with their writing, at the University of Idaho.

This study's findings suggest that ESL graduate assistants are frustrated with the lack of effective guidance that they receive from their advisors/major professors on writing-related issues, which hinders their academic success as well as their working relationships. In addition, the lack of writing support directly correlates with not being adequately prepared to write in English about their research once they become researchers in either a university or industry setting in the United States (US) or abroad. Basic communication, writing for assistantships and advisor/major professor issues (including faculty lack of time and the tendency to "take over" and re-write student writing) were the most significant challenges identified by participants when results were analyzed separately for the two key stakeholder groups.

The results of this study and similar findings nationally and internationally suggest that writing for academic/professional purposes at the graduate level is an exceedingly complex cognitive and social undertaking for ESL graduate students. The results also suggest that facilitating disciplinary rhetorical socialization is exceptionally complex and challenging for faculty. And while research has shown that cohesive discipline-specific, graduate-level writing programs that equally support graduate students and faculty result in optimized research performance and professional preparation, few exist in the US.

Introduction: The Problem and Its Importance

Universities across the United States (US) rely upon their graduate students to conduct research and teach courses. Almost 12% of the 2.2 million graduate students in the US are international graduate students for whom English is not their native language. Approximately 33% of all doctoral degrees awarded in 2005 were to non-US citizens, the majority of whose native countries were China, India, and South Korea.[1, 2, 3] Approximately two thirds of these students are in science and engineering programs: in 2006, 64% of all engineering doctoral students were international, as were 56% of graduate students in physics and 55% in mathematics.[4, 5, 6]

After graduation, 74% of these international students have firm job commitments in the US either as postdoctoral fellows or in industry. Non-US citizens accounted for 58% of all postdoctoral fellows in 2003. The majority of those who stay are from China and India.[7, 8]

Despite meeting high university standards, many graduate students for whom English is a secondary language (ESL)* continue to struggle with written communication in their academic

programs.[9, 10, 11] Many come from cultures that value different rhetorical styles in academic and professional writing. Many have also been taught differing definitions of what it means to research, document what has been researched, and pursue and illustrate through research an original idea.[12, 13] Indeed, for those who have not studied in the US prior to beginning their graduate studies, "writing in English may have been limited to non-academic writing".[14, 15, 16] These struggles can compromise the ESL graduate students' academic performance and professional relationships with their colleagues, supervisors, and students (if they are teaching assistants).[17, 18, 19]

A key component to graduate education in the US is the acceptance into a professional community. Disseminating research through publications is the primary way of joining this community.[20, 21] Often unable to communicate their research in writing according to the prevailing professional standards, these ESL graduate students are effectively silenced and cannot successfully meet the expectations their major professors have for publishing their findings or for writing up the seminal work of their graduate studies: the thesis or dissertation. In addition, English "has assumed a role as the primary international language of science and scholarship, including the Internet," which places even higher importance on international ESL graduate students to master the language to a working extent. [22, 23] And, since 74% of these students stay to work in the US after receiving their doctoral degrees, it's imperative that their English skills are robust enough to promote rather than hinder communication, collaboration and innovation.

In the Sciences and Engineering, research projects are usually funded by external funding agencies, such as the National Science Foundation, other governmental or military agencies, as well as by private corporations.[24, 25] Because faculty rely on continued funding for research, they have vested interests in not only optimizing the performance of their graduate research assistants, but also in communicating the concrete outcomes of the research conducted. Clearly, faculty who work closely with ESL research assistants as supervisors would like their students/ employees to perform as productively as possible for the duration of their courses of study.

Yet, many faculty lack knowledge about intercultural communication skills, lack understanding of the nature of second language learning, and lack understanding of the nature of teaching writing to help their ESL graduate assistants to successfully communicate their research in writing.[26, 27, 28] Faculty have very different relationships with graduate assistants than they do with other graduate students because they work closely on in-depth projects that can span months and often years.[29, 30] These relationships are "complex, enduring, and multi-faceted," where the graduate assistant often functions simultaneously as an adult learner, a mentee, a colleague in research, and an employee. In turn, graduate faculty have multiple responsibilities to not only "serve as intellectual and professional mentors…," but also to "…prepare students to be competitive for employment".[31, 32] Additionally, faculty also "must have the capacity to supervise, always, and not just be a research partner".[33, 34] Because of the complicated and often high-stakes nature of this student/faculty and employee/ supervisor relationship, building a strong and mutually respectful working partnership is critical.

Moreover, faculty who work closely with ESL graduate students struggle with responding effectively to their students' writing. Distracted by sentence-level surface errors, professors often

focus on correcting grammar instead of commenting on content and organization, a practice that neither provides students with self-editing strategies, nor introduces them to the conventions of American academic and professional writing. While both student and professor may think that correcting the ESL student's grammar is helpful, it often isn't. This focus on grammar correction can mislead students into thinking that grammar is their only problem area. In turn, faculty experience increased frustration because they often spend inordinate amounts of time editing students' work with few long-term results. This kind of help fosters tense relationships and closes doors of communication.[35, 36]

A Summary of the Study: The Case at the University of Idaho

The situation at the University of Idaho (UI), a large land-grant institution, is largely similar to that described across the nation. A traditional three-stage Delphi methodology was used to provide a confidential electronic forum for international ESL graduate assistants and faculty in the Sciences and Engineering to describe (a) their experiences and perceptions related to challenges in fulfilling or helping graduate students to fulfill writing assignments for academic programs and assistantships, as well as (b) to describe what range of university-provided services they perceived would best address the identified challenges. The study was conducted between November 2005 and April 2006. The participants in this study comprised 32 key stakeholders in the Sciences and Engineering: 15 international ESL graduate assistants (GA's) in doctoral programs and 17 faculty (assistant professor to professor)

The theoretical framework for this study is the whole systems sub-paradigm of the learning paradigm in human resource development, where the goal is to provide employees with learning opportunities that will simultaneously build individual learning capacity and knowledge, improve performance, and strengthen the organization as a whole. [37, 38] The research questions are guided by core adult learning principles and Knowles' process design for adult learning programs, wherein participants are actively involved in identifying their own needs and learning outcomes, as well as how to best address the needs and fulfill the outcomes. [39] This study's research questions are:

(1) What challenges do international ESL GA's in the sciences and engineering face in fulfilling the writing responsibilities of their assistantships and academic programs?

(2) What challenges do faculty in the sciences and engineering face in helping their international ESL GA's fulfill the writing responsibilities of their assistantships and academic programs?

(3) What range of university-provided services would best address the identified challenges?

The findings suggest that ESL GA's are frustrated with the lack of guidance that they receive from their advisors/major professors on writing-related issues, which hinders their academic success as well as their working relationships. In addition, the lack of writing support directly correlates with not being adequately prepared to write in English about their research once they become researchers in university or industry settings in the US or abroad. Basic communication, writing for assistantships and advisor/major professor issues (including faculty lack of time and the tendency to "take over" and re-write student writing) were the most significant challenges

identified by participants.   The university-provided potential solutions to the identified challenges most frequently cited were a graduate-level writing center, requiring graduate-level, credit-bearing writing courses, including those courses on the study plans, and requiring students to have a manuscript in the process of publication prior to graduation.

What do the Findings Tell Us?

What challenges do international ESL GA's in the sciences and engineering face in fulfilling the writing responsibilities of their assistantships and academic programs? The findings suggest that the four most important challenges for ESL GA's are, listed in order of significance: (a) advisor/major professor issues, (b) basic communication issues, (c) writing for their assistantships (research reports, journal article manuscripts, conference proceedings, etc.), and (d) the fact that the writing courses that are offered at the university where this study was conducted usually don't count as part of their academic study plans.

What challenges do faculty in the sciences and engineering face in helping their international ESL GA's fulfill the writing responsibilities of their assistantships and academic programs? According to the findings, faculty face the following four challenges most often, listed in order of significance: (a) re-writing ESL GA writing, (b) lack of time, (c) basic communication issues, and (d) that many won't include ESL writing support courses on graduate study plans because they aren't graduate-level, credit-bearing, discipline-specific courses. For a summary of the ESL GA and faculty challenges with descriptive statistics, see Table 1.

Table 1. ESL GA and Faculty Challenges with Descriptive Statistics N= 32 (15 GA's, 17 faculty)

ESL GA Challenges	Entire Panel		Graduate Assistants		Faculty	
	Mean	SD	Mean	SD	Mean	SD
A. Advisor/major professor issues*	2.6	1.0	2.7	0.8	2.7	0.6
B. Basic communication issues	2.6	1.02	2.5	0.8	2.7	1.3
C. Writing for assistantships	2.5	1.0	2.9	0.9	2.7	0.6
D. Writing courses don't count	2.1	1.04	2	1.1	2.1	1.1
Faculty Challenges	Entire Panel		Graduate Assistants		Faculty	
	Mean	SD	Mean	SD	Mean	SD
A. Re-writing ESL GA writing*	3.1	1.1	3.6	0.8	2.6	1.2
B. Lack of time*	2.6	1.1	3	1.3	2.7	1.3
C. Basic communication issues	2.5	1.4	2.2	1.1	2.6	1.0
D. Writing courses don't count	3.1	1.1	3.2	1.1	2.2	1.5

*All considered part of Advisor/major professor issues

The following discussion will locate the finding in the related literature and is organized in this manner: (1) advisor/major professor issues, (2) basic communication issues, (3) writing for assistantships, and (4) the issue that writing courses typically do not count as part of the study plan.

ESL GA's and faculty alike considered advisor/major professor issues to be a challenge for GA's in fulfilling the writing expectations of their academic programs and assistantships. The tendency to re-write student writing and lack of time to respond effectively to graduate assistant writing

were identified as the top two faculty challenges, both of which can be considered sub-categories of advisor/major professor issues.

Challenge: Advisor/Major Professor Issues

Participants described ESL GA challenge A as: "…working with faculty who have little time, energy, or knowledge of ESL-related issues to provide the type of feedback that ESL graduate assistants need to help them grow as writers."

One GA explained:

> *Due to the excessive work load that faculty bears [sic] both as professors and as PI's researchers, they tend to be short-tempered at times. It seems that when they are given a draft to revise they get annoyed with the amount of help they need to provide. The corrections/directions are given in a very graffic [sic]/sketchy way. It is extremely important that faculty should be advised about their "advising" of first-time writers.*

A faculty member revealed:

> *I don't think that we as faculty have the expertise to know what ESL students face. While we either try to edit their reports, papers, etc or give up in frustration, there is not the support that is needed for these students. So, the greatest challenge is that we don't have the tools or understand the needs of these students.*

Another professor noted: "…we feel that it is not our job to be teaching writing. This is a mistaken perception, but a perception nonetheless." These quotes starkly summarize some of the issues that graduate assistants have with their advisors/major professors and which are also supported in the literature.[40, 41] In another study, professors indicated that they did not consider helping ESL graduate students with their writing a professional responsibility: "…it's not my job to teach them how to write; I'm not a writing instructor. If they have major problems, they should take a writing course, hire a tutor or get an editor…".[42] Science and Engineering faculty seem to generally consider teaching writing as separate from teaching the content, values, skills, and thought processes of their disciplines.

This distinction is a false dichotomy.[43] It is problematic for numerous reasons, as described below and in the sections following this discussion. The problem is that many Sciences and Engineering faculty: a) do not consider that the teaching of writing in their discipline is their responsibility, b) do not have a meta-awareness of the role that writing plays in the construction of knowledge in their given discipline, and c) do not have the knowledge or tools to address the various complex writing-related needs of their ESL GA's (nor, some argue, those of their native English speaking graduate students). This problem is well recognized in the literature. [44, 45, 46]

Participants represented faculty challenge A as: "Faced with numerous grammatical, rhetorical and structural issues in ESL GA writing, faculty often find it easier to 'take over' and re-write the papers themselves. In doing so, they might inadvertently change what the GA is trying to say, as well as interpret the results differently."

This GA explained:

> *They (the faculty, usually engineers or scientists without previous training in writing themselves) try to overwrite the proposed drafts, making changes that to the GA they seem confusing and in cases even totally different than the written original.*

Another GA divulged:

> *… I find at times very frustrating the way my supervisor is interpreting my results. Where I know that as a student I have still a lot to learn, there many new things that my supervisor doesn't know or needs to learn as well. The edge of science offers the experience, but the years spend [sic] experiencing offer the knowledge... Just because someone have spend [sic] time as a professor doesn't necesserely [sic] mean that they have the right to change/interpred [sic] or alternate one's data or results.*

A faculty member noted that: "The communication of ideas in English is so poor that trying to edit is more difficult than simply rewriting the text entirely, which is extremely time consuming and interferes with other duties." GA's attested strongly that advisors/major professors would frequently re-write student manuscripts, misrepresent results and/or change the GA's original intended meaning. Faculty did not perceive this to occur as frequently as did the GA's.

Participants defined faculty challenge B as: "Faculty do not have the time to review and effectively critique writing to help the GA's become stronger writers."

This GA wrote:

> *My guess is that the lack of time is the greatest challenge faced by the faculty in Science and Engineering in providing a proper feedback on the writing of their graduate assistants. A typical faculty member is usually overloaded with many responsibilities and taking care of the scientific writing of their assistants is, usually, the last thing on the list.*

This faculty member described the challenge in more detail and related it to basic communication issues:

> *…The arguments are normally coherent and well-reasoned, but correcting the basic aspects of the writing wastes a great deal of time and is a significant distraction. This leads to a great indirect cost: the problems with the base level communication steal time that I could be spending on the science and engineering.*

That faculty have multiple responsibilities -- and attendant time constraints -- is without question or need of proof. ESL GA's indicated that they do not receive the quantity or quality of interaction from their advisors/major professors on their writing, which to them translates as faculty not being interested in or attentive to their ideas and innovations. This faculty inattention can in turn be interpreted as disinterest in the GA's research; for the GAs, who are researchers in training, it is their research that makes up who they are.

In other similar studies, ESL GA's claimed to be aware that interactions with professors is encouraged and valued in the US academic environment, but that they came from cultures where student/faculty relationships are quite distant, "in which students are not expected to seek advice from professors or are not allowed or encouraged to engage in student-professor interactions at all". [47, 48]

While this study's participants did not mention this to be a factor, lack of communication, information sharing, or co-construction of knowledge through research could explain why graduate assistants felt re-writing/re-interpreting research to be a significant problem and faculty did not. Perhaps students were uncomfortable or even afraid to approach their advisors/major professors about the issue and perhaps faculty were unaware of the cultural differences and did not include students adequately in conversations about their research, interpretations of the data and their communication of that in writing.

Challenge: Basic Communication Issues

Basic communication issues had a multi-faceted definition: "ESL graduate assistants struggle with the fundamental communication requirements of writing in English (grammatical errors, organizational/ structural issues, use of rhetorical styles not common to the US scientific and engineering communities)" and "Numerous grammatical, rhetorical, and structural issues in ESL graduate assistants' writing make it difficulty for faculty to focus on content."

In general, GA's indicated that organizational and rhetorical issues posed greater challenges for themselves than those grammatical, while faculty generally indicated the opposite. Many GA's noted a general unfamiliarity with scientific/technical writing and that becoming more familiar through practice was one of their primary objectives. Faculty, in general, concurred that GA's need more familiarity and practice writing scientific/ technical texts. However, faculty indicated with more frequency that basic, sentence-level errors were often so severe that it hindered the reader's comprehension of the text, thus recommending that graduate assistants needed to become more proficient in basic English before addressing rhetorical issues. And while many graduate students in this study noted that they encountered sentence-level issues (grammar, syntax, etc.) regularly, they considered them to be less significant a problem than did faculty.

Only one faculty member in this study seemed to concur:

> *My personal experience with my dozens of ESL graduate students is that they can write with a clarity that comes from multilingual abilities. I have been pleasantly surpurized [sic] by how fast grammer [sic] is mastered or already in place. …The challenge for ESL students is the mindset of trying to persuade, present an argument, defend, take responsibility and "fight for it".*

These observations and experiences are supported in the ESL composition and ESL adult education literature. While there have been no studies with the same focus as this one, those that are similar indicate that "peculiarities of the U.S. academic style" and its impact on language choice, text structure and organization, as well as additional disciplinary rhetorical specifications,

pose significant obstacles for international graduate students, obstacles of which the students themselves are generally well aware. [48, 49, 50]

It has also been noted that many international ESL graduate students have not had much experience writing either academically or professionally in their native countries (although none of the panelists in this study mentioned evidence of this) and that this lack of experience can have a subsequent negative effect on writing in a non-native language. Indeed, previous studies note that many faculty fail to ask or even consider that students may not have had any or even moderate practice in academic writing prior to beginning their graduate studies.[51] A professor interviewed in another study observed, "I had falsely assumed that the students had [academic writing knowledge] and I never even asked myself how and where they've [*sic*] got it".[52]

That the faculty in this study would consider sentence-level errors more of an issue for GA's than the GA's would consider it themselves is not unusual. The phenomenon of the reader's attention being "high jacked" by numerous sentence-level mistakes or peculiarities and, subsequently, "unable" to focus on content is well supported in the literature.[53, 54] After all, faculty serve as readers and have specific reader-based expectations for general correctness and clarity in a given text.

An ESL writer, on the other hand, has multiple foci when writing an academic text. Both academic and professional research writing require

> a complex combination of generating ideas, selecting the ideas that are appropriate to the writing task, translating these into text and polishing the text to produce a presentable document. In doing this, the writer has to attend not only to his or her own thoughts, but also to the content and style conventions of the community for whom the piece is being written.[55]

Add to this the additional challenges of writing in a non-native language and the complexity is doubled. According to the ESL graduate assistants in this study, they are more aware of and concerned about gaps they have in accurately representing their ideas and research according to appropriate academic and/or professional rhetorical criteria than about sentence-level issues. Raising both the ESL writers' and the faculty's awareness of the multiple layers of the ESL writing process can help in guiding the path to a solid product more effective and efficient.

Challenge: Writing for Assistantships

Participants described ESL GA challenge B as, "The writing required of their assistantships seems to pose the biggest challenge. Contributions to conference proceedings, grant proposals, and journal articles often have short time submission and require concise, accurate and complete descriptions of the research." Both GA's and faculty in this study perceived that this type of writing was a challenge for GA's. While participants did not include writing for assistantships as one of the faculty challenges, it is apparent from the preceding discussions that faculty play a large role in the degree to which GA's successfully fulfill assistantship writing responsibilities, especially since their university does not consistently provide ESL writing support for this purpose.

Much of what panelists described as basic communication concerns regarding organization/ structure and rhetorical issues fit into this writing for assistantship category or, rather, writing in the profession. The literature supports that many graduate students, both ESL and native English speaking, are indeed charged to write for professional purposes fairly regularly.[56, 57, 58]

Although graduate students may not be called upon to write for academic/ professional audiences and purposes as regularly as faculty or active professionals in the field, it's the responsibility of any graduate program to prepare students to function professionally in the discipline, and that guiding writing for professional purposes should be part of that preparation.[59, 60] Thus the graduate assistant in the sciences and engineering takes the role of a research colleague in training. Induction into a given discipline is imperative and those who take it seriously recognize both the potentials and the pitfalls. Unfortunately, the problems associated with guiding students through the ways of thinking and communicating in a given field are many, often unrecognized, and often woefully unattended to. The following quote focuses on students in the engineering discipline:

> These new expectations for professional communication are seldom articulated explicitly, yet engineering professors commonly expect graduate students to be experts in the rhetoric of the research-oriented project. The predictable result is an awkward period of transition in which the students learn the new writing expectations by trail and error, a process that is painful for all students and is particularly challenging for international students. [61]

The graduate assistants in this study wrote about their "trial and error" experiences quite clearly. One explains:

> *Firstly I don't think I get enough initial directions about the format that I need to follow. In general the idea of the paper originates as letter format, but with the time (after we figuring out this or that detail; wrong/right; not as good/not as bad...) the focus starts drifting away towards more applied field paper, sometimes it becomes even like a review paper.*

Another ESL graduate assistant simply shared, "Once you pass the minimum, no one cares about your writing skills... [*sic*].

The socialization of graduate assistants into the discipline, or the profession, takes on greater import when one recognizes that rhetorical knowledge, skills, and abilities influence directly the ability to critically analyze data and issues important to scientists and engineers in the field. Norgaard notes that, "Although novice engineers [and scientists] may see data and evidence as incontrovertible, persuasive in their own right, disciplinary knowledge and expertise are in fact formed through interpersonal and textual negotiation over interpretations of that evidence".[62] This negotiation of knowledge is critical to all disciplines, and especially to those in the sciences and engineering where being rhetorically able can help one to move into realms beyond observation and measurement, into realms of possibility, of generativability.[63] It is well recognized that "scientific work does not become effective science until it is communicated and subjected to public scrutiny". [64, 65]

In addition, "scientists and engineers are characteristically visual-spatial thinkers and communicators" who frequently use both analogy and metaphor for "creative thought and in communicating their thinking" with colleagues and the public.[66] Indeed, the analogic or metaphoric "power of language is strongest if it evokes an image.[67] In order to effectively communicate the complex interrelationships between language and visual-spatial representation, the scientist/engineer must have sophisticated written communication skills in English. With this in mind, it becomes clear that disciplinary content mastery can not and should not be divorced from mastery of the discipline's rhetoric. Thus, "interactive socialization" is crucial in helping graduate assistants construct the agency that is important for them to become innovative researchers and more "reflective, confident and self-directed" as adult learners.[68, 69]

So, while students and faculty of science and engineering with differing native languages have the ability to converse in highly constrained mathematical and technical languages, they also need to have the ability to describe their inspirations and intuitions, as well as explain connections they might have to other experiences in their unique pasts. When the participants in such a complex dialogue of process and possibility (not entirely expressible through the derived logical systems that make up mathematics) come from radically different cultural traditions and speak different languages, it is especially critical that the participants recognize the value of this type of communication in strengthening the future process and products of their research together.

Challenge: Writing Courses Don't Count on the Study Plan

ESL GA challenge D was defined as: "ESL graduate assistants hesitate to take writing classes because there are very few offered at the graduate level and they don't count as part of their study plan." Faculty challenge D was quite similar: "Many faculty won't include ESL writing support courses in the graduate study plan because they aren't graduate-level, credit-bearing, discipline-specific courses."

At the University of Idaho, only non-graduate-level, non-credit-bearing, non-discipline-specific ESL writing courses are consistently offered. They are offered through the university's intensive English program, are very time intensive and are expensive. A 300-level technical writing course tailored to meet undergraduate needs is offered through the English department, but it is not consistently taught by an ESL specialist, and it also has pre-requisite requirements of other undergraduate English courses, which may not be appropriate for the ESL graduate student. While panelists noted that occasionally a graduate-level, credit-bearing course was offered through a natural resource science department, it was not really appropriate for students outside the discipline and did not necessarily meet ESL graduate student needs for induction into the rhetoric of the discipline, and it was not taught by an ESL specialist.

Faculty comments highlight some of the institutional barriers this particular problem faces in the current UI system. One professor noted that, "Faculty often are not willing to include writing support courses as part of the graduate study plan. Therefore, students opt to not take courses that are offered because they add to an already very heavy course load." Another said: "…several faculty members [say] that they won't approve [even a graduate level writing course] on a graduate study plan unless it is taken as an extra course. They basically don't see it as a viable replacement for a technical course." This professor added, "Many [students] are unwilling to

take a communications or technical writing course since they don't count for graduate credit and/or don't want to take the prerequisite courses needed to enroll in technical writing (ENG 317)." Another faculty member wrote: Our department generally doesn't accept 300 level or lower courses on a study plan." This professor added: "There's the rub: courses don't count toward graduation; advisors don't recommend them because it seems inefficient. The concept of an investment eludes both advisor and student."

The paucity of graduate-level, credit-bearing, discipline-specific courses at the UI is not unique; it is the case at many research institutions across the nation. While many undergraduate Science and Engineering programs across the US value and offer "in house" credit-bearing writing courses (for all their students, not just those who have English as a secondary language), it is rare to find them at the graduate level. However, the literature suggests that those institutions that do offer such courses and even require them are rewarded not only with stronger graduate student writers, but also stronger researchers. A majority of this research has been conducted at institutions of higher education in the United Kingdom and Australia where the ESL writing support systems are stronger and have been in place for often over a decade. [70, 71, 72, 73, 74]

The Most Effective Potential Solutions

This study's third research question was: *"What range of university-provided services would best address the identified challenges?"* Panelists, in general, indicated that a graduate-level writing center and the requirement of graduate-level, credit-bearing, discipline-specific writing courses would be the most effective solutions to the identified challenges. A summary of the eight challenges and top potential solutions can be viewed in Table 2.

GA's and faculty alike considered a graduate writing center to be an effective solution for two of the ESL GA challenges: basic communication issues and writing courses don't count. Both GA's and faculty indicated that requiring graduate-level, credit-bearing, discipline-specific writing courses would be an effective solution to the majority of the challenges, along with including those courses on study plans.

In addition, GA's perceived with much greater consensus that requiring them to have an accepted, in-press, or published manuscript prior to graduation (with the appropriate accompanying support system to foster success) would be an effective solution to many of the identified challenges. GA's also indicated that they thought faculty would benefit from participating in faculty development opportunities geared toward teaching them how to better address ESL graduate assistant writing issues, while faculty categorically rated this solution as the least effective.

Potential Solution: A Graduate Writing Center

In round three, this university-provided service was defined as: "A writing center with graduate-level tutors who have scientific, technical and/or engineering backgrounds." Participants indicated that this would be an effective solution for two ESL GA challenges: basic communication issues and the fact that writing courses often don't count as part of the graduate study plan. That this service was identified to most effectively address only two challenges is

most likely due to the primary characteristic of writing centers: to get additional assistance on writing that is primarily guided by faculty.

Table 2. Challenges with Most Effective University-Provided Potential Solutions*

ESL GA Challenges	Potential Solutions (entire panel rating)		
		Mean	SD
A. Advisor/major professor issues	Graduate-level writing courses	4.0	1.1
B. Basic communication issues	Graduate-level writing center	4.0	0.9
C. Writing for assistantships	Graduate-level writing courses	4.3	1.0
D. Writing courses don't count	Graduate-level writing center	4.1	0.9
Faculty Challenges	Potential Solutions (entire panel rating)		
		Mean	SD
A. Re-writing ESL GA writing	Published/accepted manuscript	4.8	0.4
B. Lack of time	Graduate-level writing courses	4.2	
C. Basic communication issues	Graduate-level writing courses	4.6	0.9
	Published/accepted manuscript	4.6	
D. Writing courses don't count	Graduate-level writing courses	4.5	0.9

*N= 32 (15 GA's, 17 faculty)

Undergraduate writing centers are ubiquitous among four-year higher education institution campuses and while there are an increasing number of graduate writing centers nation wide, they are not legion. The research has generally shown that the writing center peer tutoring model is not only cost-effective, but also effective in helping students increase their written communication abilities and in fostering the life-long learning skill of seeking feedback from others for continual improvement.[75, 76]

Most undergraduate writing centers face the problem of overcoming a wide-spread misconception that such centers primarily provide proofreading and editing services, which most categorically do not. Rather, their primary purpose is to help the student understand the writing task, its parameters, and how to best fulfill the assignment's outcomes within the given time frame, while teaching students about the writing process and self-help strategies. It is also well cited in the literature that since the 1980's, US undergraduate writing centers have been serving a growing population of ESL graduate students, which is the case at UI as well.[77] This is problematic because most peer tutors are undergraduates trained to meet undergraduate writing needs and so graduate students who visit writing centers may not receive the kind of targeted assistance they need. In this study, GA's generally rated a graduate writing center's effectiveness in addressing the identified challenges lower than faculty did. Although not specifically mentioned, perhaps GA's who had visited the UI undergraduate writing center found it did not meet their needs, or they shared the common misconception that tutors would serve primarily as proofreaders.

As mentioned earlier in this discussion, graduate-level, credit-bearing, discipline-specific courses are rare in the US, which could explain why graduate writing centers are more numerous, in addition to the fact that there is a well-documented need for graduate student writing support. A 1995 study that surveyed 75 US graduate institutions about their writing support for graduate students found that graduate students who sought writing center assistance primarily asked for

help in learning the "conventions of their discipline, terminology, [and] the 'moves' commonly made in scholarly articles".[78]

Writing centers that hired and trained discipline-specific graduate students to work with students in the same discipline reported more success. Writing centers that had collaborative relationships with the students' advisors/major professors reported even more success in helping students with their writing-related needs, as well as in teaching faculty effective strategies for guiding the writing process. The types of learning environments defined in the latter two examples are those where "students learn through interaction with faculty and peers to become members of their disciplinary communities" and which mimic the adult learning communities that they are most likely to encounter after finishing their degrees and beginning their professional lives, thus fostering life-long learning skills.[79]

Potential Solution: Graduate-level, Credit-bearing, Discipline-specific Writing Courses

These courses were defined in the following manner:

> Graduate-level, credit-bearing courses for scientific and technical writing. Specific product outcomes could be: research proposal, chapter of a thesis or dissertation, conference proceedings, journal article manuscript, etc. The supervisor of each student could also be involved in the process of responding to the writing the students produce, along with the course instructor to expand the writer's audience.

In general, participants indicated that courses with the above outcomes would be the most effective potential solution to faculty challenges regarding (a) basic communication issues, (b) the fact that writing courses don't count, and (c) the approach of re-writing ESL graduate assistant text. This potential solution was also rated as effective for all other challenges. GA's underscored the importance of having an accepted/in-press/published manuscript as one of the product outcomes of such courses with much greater consensus than did faculty. Although GA's did not specify why, the reason may be that GA's are very aware of their status as researchers in training and understand the value of publishing in one's discipline to secure postdoctoral positions, tenure-track faculty positions, or research positions in industry.

Interestingly, courses with all three distinguishing characteristics (graduate-level, credit-bearing, discipline-specific) in US higher education are the source of considerable controversy. While US community colleges have long offered credit-bearing ESL courses, four-year and graduate institutions rarely offer them. This is, in part, because language skills are frequently seen as a "conduit" for content, or something to obtain prior to beginning one's course of study. Thus, those in need of ESL support are generally required to take "remedial" English courses (often offered elsewhere, not on campus), to graduate from an institution's intensive English program, or to take English composition classes that have ESL sections, if offered by the institution.[80]

This most common approach considers language as a "tool that in itself is devoid of any intellectual value" and which views students as "patients who are deficient in 'basic skills' and must be cured". And it is this view that bolsters many institutions' argument that providing such courses is not financially feasible since they do not consider it their responsibility to "remediate".

However, if one recognizes that learning the language of a given discipline is inextricably linked with learning its content, values, research paradigm and other critical abilities, then one can see how important it is to provide courses that help students become successfully literate in the disciplinary culture and research practices.[81] Two quotes from panelists in this study highlight how far many people are from embracing this view: "…several faculty members [say] that they won't approve [even a graduate level writing course] on a graduate study plan unless it is taken as an extra course. They basically don't see it as a viable replacement for a technical course," and "There's the rub: courses don't count toward graduation; advisors don't recommend them because it seems inefficient. The concept of an investment eludes both advisor and student."

In a recent article describing a graduate-level, credit-bearing Computer Science technical writing/ research methods course offered at Virginia Tech, the author notes that his department's approach to successfully preparing graduate students for their graduate student career and future professional career is not common and initially met much resistance from faculty. In general, faculty considered the teaching of writing in the discipline at the graduate level unnecessary since a writing course is decidedly un-technical and that students typically have had sixteen years of writing instruction prior to entering graduate school. Yet, his department could not ignore that native English speaking students and ESL students alike were not equipped to conduct research and communicate that research in writing at what they considered to be graduate-level proficiency.[82]

Shaffer explains that prior to the new technical writing/research methods course, the most common "solution" to the inadequate preparation of many incoming graduate students (an inadequacy not unique to Virginia Tech, one of the most well- respected engineering institutions in the nation) was to simply "leave the students to absorb this information during the natural process of their graduate career, with any remaining gaps made up through on-the-job training by the research advisor". This approach, he argues, is inefficient and does a disservice to students and the program alike. While this course remains controversial among some faculty who espouse a remedial view of language skill acquisition, it "receives consistently strong enrollments" and appears to be a "central pillar of our graduate curriculum," playing a pivotal role in "restructuring [the] graduate program to be more focused on research" and producing graduate students with stronger research literacy and the writing skills to communicate their research.[83]

As previously noted, graduate-level, credit-bearing writing courses with the objective of fostering disciplinary language and research literacy, or the rhetorical negotiation of expertise, are rare in the US.

A summary of the key components that make some of the writing courses that are embedded in the undergraduate science or engineering curricula could be useful in planning graduate-level courses:

> (a) The course or series of courses should be taught by a disciplinary expert; if this is not feasible, then it should be co-taught with a writing expert, preferably one with Teaching English as a Second Language (TESL) training.

(b) If the course is taught solely by a TESL instructor, then there should be close collaboration with faculty in the discipline.

(c) Only authentic writing assignments, such as those scientists and engineers would be required to write professionally, should be assigned.

(d) Critical analysis of research papers should be part of the curriculum and should inform the students' understandings of what it means to rigorously research in the field.

The correlation between courses that have these characteristics and subsequent growth in student disciplinary writing and critical thinking skills have been well recognized, although most of the literature report case studies at particular institutions and not comparisons of offerings across the nation.[84,85,86]

Australia and the United Kingdom have been at the forefront of offering graduate-level, credit-bearing, discipline-specific writing courses in the sciences and engineering for well over a decade.   Their institutions of higher education and their national governments have come together to create national agendas based on the belief that graduate programs have the fundamental responsibility to grow the writing skills that will enable students to publish their research findings in academic and professional contexts. And, increasingly, these programs have focused on inducting the graduate students into the "extended rhetorical conventions and discipline specific conventions".[87]

A survey of such courses offered at Australian universities during 2002-2003 showed these variations: Professional Communication for Engineers, Communication and Critical Analysis, Engineering Communication, Presenting Academic Discourse – Engineering Stream, Analysis and Writing, English for Professional Purposes. Some are offered solely to ESL graduate students, others include native English speakers. The majority have the characteristics of effective writing courses in the discipline summarized above, with even more emphasis on the close collaboration between the student, the TESL expert, and the graduate student's advisor/major professor/research supervisor. That these courses are more widely offered and better established within science and engineering programs in Australia does not mean that they are fully supported by faculty in those programs. All the research surveyed notes some lingering faculty reticence, generally among those who adhere to "conceptions that divorce mastery of domain content from rhetorical process".[88, 89, 90]

Most of the courses surveyed have the experimental design process of the particular discipline embedded into the curriculum in order to maximize application of the outcomes into the students' own research and foster life-long learning practices. The findings of studies on the efficacy of these programs (in the US, UK, and Australia) show that they are effective in growing the essential critical and analytical skills needed by strong researchers in any discipline, especially when there is substantial advisor/major professor/research supervisor collaboration.[91,92,93]

Another approach is to not offer separate writing courses, but to integrate writing throughout the curriculum, although this requires significant administrative support and faculty commitment and, thus, is a much less common approach. In 1994, Stanley Rolfe, previous chair of the Civil Engineering department of the University of Kansas, launched a comprehensive plan to embed writing into their curriculum and teach undergraduate engineers how to write *as* engineers, not simply *like* them: "It is not sufficient to be knowledgeable about your technical field," he said. "You must also be able to communicate that knowledge to others". The result was a collaboration between the university's Writing Across the Curriculum (WAC) program to work closely with the department's faculty in workshops so that faculty could grow the skills necessary for them to prepare their students to be successful research professionals. This writing program is still thriving and has been adopted by the entire School of Engineering at the University of Kansas.[94]

Potential Solution: Faculty Development Workshops

Participants gave these specifics for faculty development opportunities:

> Faculty workshops that underscore the value of requiring ESL GAs to take courses that would help them with their written and verbal communication skills (faculty often value this for undergrads, but not grads). By increasing the ESL GAs' skills, the faculty and department could benefit more from the ESL GAs' scientific/technical expertise.

A faculty member in this study noted: "This will be quite effective. Unfortunately, convincing the faculty to attend and learn will be the most difficult part of this recommendation." While this professor agreed that such focused offerings would be effective and while other faculty panelists recognized that they don't fully understand ESL writing issues and are not equipped with the appropriate tools to help their graduate students effectively with their writing, they consistently rated faculty development workshops as the least effective university-provided service to help them address the identified challenges.

All of the issues described in this discussion underscore the need for faculty development so that faculty can fulfill their roles as advisors/major professors/supervisors more successfully. The literature suggests that in the US, faculty essentially have no guidance regarding how to effectively advise and supervise their graduate assistants to optimize research and communication of their research productively. On the other hand, higher education institutions in the United Kingdom and Australia have been actively addressing this issue at the national level through the collaborative creation of programs to build the capacity of both graduate students and faculty, with the goal of increasing program effectiveness, as well as research quality and innovation. All studies cited underscore the importance of faculty participation in university-sponsored faculty development workshops in order to increase faculty effectiveness in facilitating the writing process.

Limitations and Recommendations for Further Research

While this study's findings provide substance for rich discussion, it is important to recognize that the implications are limited. While it is typical for a Delphi study to draw data from a small

expert panel, this particular panel could be viewed as smaller than recommended because the two expert groups had distinctly different demographics. The overall participant size was 32, which is considered acceptable in the Delphi literature. However, it is notable that 15 were international graduate assistants and 17 were faculty. Had each stakeholder group equaled 30, then the expert panel input may have provided a more accurate representation of the targeted population's perceptions and experiences on the UI campus. In addition, there was not equal panel representation across programs or colleges, which limits the generalizabilty of the findings as well. Only general recommendations can be made from the data and not to individual program improvement. Attention was not paid to the gender of the participants, therefore it is difficult to surmise whether the perceptions and experiences are similar across genders. Native cultures were not identified, which means that conclusions related to research conducted on differences among cultures can not be explored.

While response rates were fairly high (e.g., 80% in round one; 83% in round two; 66% in round three), there was significant attrition in the third round, which could have skewed results. In addition, UI is a rural land-grant university and therefore the perceptions and experiences described in this study can not be assumed to exist elsewhere, although the discussion of related studies shows that there are similar trends nationally and internationally. As well, some research has shown that survey research is not well received in certain cultures and that survey research requiring written response to open- ended questions among non-native speakers of the given survey language can skew results.

Although this study's target population was limited to graduate assistants in the sciences and engineering, one could suggest that non-native speakers of English who are not graduate assistants in the sciences and engineering as well as those in other disciplines face similar challenges. Many of the studies similar to this one suggested that native speakers of English in graduate school also face very similar challenges in fulfilling the writing responsibilities of their programs.

The arena for further research is broad. The purpose of this study was to provide a baseline measure of current challenges and possible solutions identified by the target population to use as a springboard for discussion among UI faculty, graduate students and administration. These findings could be used in an official needs assessment at the program, college or university levels.

Research to directly extend this study and make the findings more robust would be to facilitate a series of focus groups and interviews drawn from the expert panel to elicit further elaboration or explain rationales for responses, as well as explore more fully other dimensions of the issue. In addition, artifacts such manuscripts written by graduate assistants, as well as the writing tasks assigned by faculty and their written feedback could be analyzed to confirm or refute this study's findings.

As mentioned earlier in this discussion, much of the similar research have been case studies and targeted needs assessments. It would be interesting and beneficial to involve interested cohorts at other research institutions across the nation. Additionally, since there has been so little research conducted that quantifies the contributions that international graduate assistants have

and have had on the research innovations enjoyed by the US, more research in this area would help in establishing a strong rationale for a cohesive, comprehensive national agenda to address the issues described in this study and those with similar focus.

National and International Implications

On March 17, 2005, Lawrence H. Bell, Director of the International Education Office at the University of Colorado, Boulder and the Vice President for Public Policy for NAFSA testified before the joint subcommittees on Select Education and 21st Century Competitiveness Committee on Education and the Workforce at the US House of Representatives on this issue. His testimony emphasized the considerable contributions that international students and scholars make to "education, teaching, and research…to the US economy…and to US national security and international leadership". Indeed, Bell proceeded, the scientific exchange that occurs between international students and their faculty partners in research "is – and long has been – crucial for the scientific leadership that underpins" the protection of US national security.[95]

In the US, approximately 33 percent of all international students are graduate students, with approximately two-thirds who study in the sciences or engineering. During the 2007-2008 academic year, these students contributed an estimated $15 billion into the US economy through spending on tuition and living expenses. These numbers help make US higher education the nation's fifth largest service sector export, according to the US Department of Commerce. In spite of these encouraging numbers and university efforts to increase global representation on their campuses, since 1985 the US has lost approximately ten percent of its international students to other English-speaking countries such as Australia, Canada, New Zealand, and the United Kingdom.[96,97,98]

While the US remains the leading destination for international students studying abroad, it cannot assume that this will always be the case and complacency on the part of US higher education institutions could have significant negative repercussions. A 2006 report "Restoring U.S. Competitiveness for International Students and Scholars" warns:

> The best and brightest from around the globe are now a sought-after commodity, and are able to choose from many centers of excellence where they can ply their creative skills. Yet, while other countries are working hard to access the benefits gained from educating the next generation of world leaders and from attracting the world's scientific, technological, and intellectual elite, the United States is curiously disengaged, content to compete with speeches, sound bites, and photo ops.[99]

While much of the national discourse focuses on removing visa restrictions, lowering tuition rates, and providing more opportunities post graduation, few recognize this population's contributions to US research and innovation and do not underscore the importance of actually preparing international graduate assistants to function fluently in English in order to communicate their research.

The future of the United States acutely depends on "our universities' capacities to produce highly educated thinkers who will comprise the advanced guard of inquiry and practice in their fields".

Debra Stewart, President of the Council of Graduate Schools, maintains that international graduate assistants in the sciences and engineering are "key players in producing the research and innovation on which a prosperous US economy and domestic job creation depend". Results from a recent econometric analysis linking US innovation and patent awards with international graduate student research conducted by a consultant and a lead economists to the World Bank as well as by a faculty member in Economics indicate that "the presence of foreign graduate students [in sciences and engineering] have a positive and significant impact on future US patent applications and grants awarded to both firms and universities".[100]

In an effort to make tangible the contributions of international graduate assistants, University of Rochester Dean of Graduate Studies Bruce Jacobs studied those contributions made by Rochester's foreign-born faculty and graduate students in the sciences and engineering. He found that 32 percent of Rochester's doctoral graduates who are considered academic leaders in US science, technology, engineering and medical fields were born abroad and posited that "it appears that former international graduate students may well have a substantial role in training America's best and brightest". Additionally, he found that between 2000 and 2005 research team members (graduate students and faculty) with significant patent awards who were not US citizens made up 42 percent of all inventors. He concluded that international research assistants at Rochester clearly are a "key component to the invention process".[101]

Conclusion

The results of this study and those similar discussed in this paper suggest that writing for academic/professional purposes at the graduate level is an exceedingly complex cognitive and social undertaking for ESL graduate students. The results also suggest that facilitating disciplinary rhetorical socialization is tremendously complex and challenging for faculty. If these students are to meet the same requirements as their native English speaking counterparts, then they and their advisors/major professors need to invest larger amounts of focused, quality time to achieve those objectives.

All of the literature highlights how crucial it is for advisors/major professors/research supervisors to actively collaborate in the socialization of ESL graduate assistants into the discipline's rhetorical culture and that to achieve the meta-awareness necessary to effectively do this, then the higher education institution needs to be committed to providing continuous and appropriate learning opportunities for their faculty. It is noteworthy that those institutions of higher education that are nationally supported in this effort achieve greater participation and greater results in supervisor performance, and subsequent graduate assistant research performance, as well as overall organizational improvement and strength. The United States does not have such a national agenda and relatively few higher education institutions have the foresight to invest substantially in cohesive, comprehensive writing programs that support equally both graduate students and faculty in their efforts to optimize research performance and preparation for future professional life.

* The author recognizes that the terms English as a Second Language (ESL) and English as a Non-native Speaker are politically charged. She also recognizes that the dominance of English in many research fields at the expense of other languages is potentially problematic. While

native English speakers may indeed represent a minority around the globe, English continues to be the international language of research. What is different in the 21st century is that many supervisors of international ESL graduate students come from non-English speaking backgrounds themselves, adding to the complexity of the communication situation.

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