Creating a Culture of Communication: A Graduate-Level STEM Communication Fellows Program at a Science and Engineering University

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Abstract: A flurry of recent research in writing studies has addressed the need for more systematic approaches to graduate-level writing support, though more research is needed into more organic models that account for graduate students' specific needs and that build infrastructure for writing support within university departments. This chapter reports on a graduate-level STEM Communication Fellows program at a science and engineering research university, in which graduate students in science and engineering fields help launch discipline-specific writing support in their home departments. The chapter begins with a discussion of program goals and departmental contexts. Then, two graduate STEM Fellows share their experiences developing support mechanisms in Earth and Environmental Sciences and Mechanical Engineering. Last, program assessment data from surveys and follow-up interviews are discussed. Findings from the STEM Fellows' narratives and assessment data demonstrate different degrees of success as fellows wrestled with intricacies of the different departmental cultures. Findings also indicate the need for more structured mentoring opportunities between advanced and incoming graduate students, more focus on unstructured writing support over writing courses, and more development of asynchronous methods of peer interaction.

Keywords: Graduate Writing Support, STEM, Science and Engineering Writing, Writing Groups, Distance Education, Thesis and Dissertation Writing

As Mike Rose and Karen McClafferty (2001) argued nearly two decades ago, very little effort has been made in many universities to address graduate-level writing support in any "systematic" way. While a flurry of recent research in writing studies has addressed this issue (Aitchison & Paré, 2012; Simpson, 2012; Simpson, Caplan, Cox, & Phillips, 2016; Starke-Meyerring, 2011), more research is needed to identify graduate writers' specific needs and to develop writing resources tailored to these needs. Two specific problems emerge as we discuss graduate writing program

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design. First, as Steve Simpson (2012) argued, many of our existing WAC/WID models are designed with undergraduates in mind. The idiosyncratic and distributed nature of learning in graduate school requires us to rethink our "knee-jerk models of writing instruction (i.e., offering preparatory writing classes) and explore [. . .] models that better fit within students' existing academic networks and learning rhythms" (p. 102). Second, as Claire Aitchison and Anthony Paré (2012) have indicated, given the importance of writing to graduate students' professionalization, writing support should not be "isolated" within service entities on campus. Rather, universities should "suffuse the [graduate] curriculum with writing" (p. 20). Creating this pervasive emphasis on writing necessitates writing centers and WAC/WID programs developing critical cross-campus partnerships and helping build infrastructure for writing support within university departments.

This chapter reports on the development of a graduate STEM Communication Fellows program developed at New Mexico Tech. While based loosely on "writing fellows" programs implemented at the undergraduate level, this graduate-level program creates opportunities to develop organic, student-run programs catering to the writing activities most suitable for students' disciplines and to develop more community among graduate students both in our Writing Center and in students' home departments. Most significantly, this chapter is co-authored with two of the original graduate STEM Communication Fellows, one from Geology and one from Mechanical Engineering. Thus, we discuss the goals and logistics of our program design and foreground the students' own voices, allowing them to use their own words to provide their perspectives and describe successes and setbacks as they worked with peers to develop a community of writing in their home departments.

The chapter begins with a discussion of the program goals and institutional setting. We then include narratives written by the STEM Communication Fellows describing their work creating department-specific initiatives and navigating the intricacies of their home departments' cultures. We conclude with general program assessment data and recommendations for program design, which includes a call to rethink what "community" might mean for graduate students, and an update on the evolution of the program since the pilot project. Our goal is to challenge the field to address a demonstrated need by considering a wider range of program designs better suited for graduate students and to provide other WAC/WID researchers and administrators with ideas for implementing similar programs suitable for their own contexts.

Program Development at New Mexico Tech

The New Mexico Institute of Mining and Technology (NMT) is a small science and engineering research university in south-central New Mexico. While small (1,563

undergraduates and 539 graduates), NMT has strong specialized programs in mechanical engineering, atmospheric and astrophysics, earth sciences, and petroleum engineering. Like many universities, NMT has become concerned with both the attrition and completion rates in its graduate programs and with the general quality of the graduate experience it provides. (For more on graduate education reform, see Council of Graduate Schools, 2010; Golde & Walker, 2006; Lee & Danby, 2012).

In 2009, NMT was granted a Title V: Promoting Postbaccalaureate Opportunities for Hispanic Americans (PPOHA) grant, the first Department of Education grant for graduate students. Among the initiatives proposed in the grant, NMT sought to provide a better range of graduate-level communication support and to encourage more community and peer-to-peer mentoring among graduate students. Despite NMT's small size, which in theory should encourage more community, NMT graduate students are still isolated in their labs and report receiving very little feedback on their writing projects from other graduate students.

Graduate program development occurred in stages and was built on cross-campus partnerships that Julie Dyke Ford had been nurturing between the Technical Communication program and the Mechanical Engineering Department, which started in response to ABET criteria for clear communication and feedback from alumni and employers. The initial stages of graduate program development at NMT involved collaboration between the Center for Graduate Studies, the Technical Communication program, and the Writing and Oral Presentation Center, and began in fall 2010 after Steve Simpson joined the faculty of the Writing and Oral Presentation Center. Initial writing and communication initiatives included three programs: science and engineering communication classes, which were initially linked with seminars in specific STEM disciplines; graduate student consultations in the Writing and Oral Presentation Center (which had previously only served undergraduates); and thesis and dissertation "boot camps," weeklong intensive thesis workshops for graduate students at the writing stage. More detailed descriptions of these programs can be found in Simpson's publications (2011, 2012, 2013; Simpson et al., 2016).

These initial programs succeeded in two important ways. First, they provided program developers with opportunities to work directly with faculty from STEM disciplines. Ford continued her work with Mechanical Engineering through a linked graduate communication in engineering, and Simpson partnered with Physics. The early success working with these programs led to collaboration with other departments, such as Earth and Environmental Sciences and Electrical Engineering. Second, these programs initiated numerous cross-campus dialogues on more organic communication models within university departments. Mechanical Engineering's interest in bolstering in-house communication resources led to Julie Ford taking a joint appointment between Technical Communication and Mechanical Engineering, and later a full appointment in Mechanical Engineering. (For more on Julie's transition into Mechanical Engineering, see Ford, 2012). The Physics

Department started plans to revise a required graduate lab to include introductions to research and scientific communication. Further, faculty in the Earth Sciences Department had noticed how many graduate students participated in boot camp and likewise grew interested in encouraging similar activities in their department. As these discussions started, we found that a more flexible graduate resource was needed to nurture these budding programs within departments and to continue supporting students from other departments. Thus, in summer 2012, we began our STEM Communication Fellows program.

The STEM Communication Fellows act as a bridge between the original three initiatives and the academic departments, channeling students between the formal graduate initiatives and department-specific initiatives and filling in the gaps between the two. STEM Fellows are graduate students from STEM disciplines trained in tutoring peers in writing and oral presentations. They spend part of their time working with native and non-native English-speaking graduate students from all disciplines in the Writing and Oral Presentation Center and part of their time helping their home departments develop in-house communication resources. While we did not require prospective fellows to be expert communicators from the beginning, we previewed their writing for evidence of a strong communicative base and interviewed them to discern their awareness of their own writing processes. STEM Fellows participate initially in a two-part, four-hour training session that includes readings in peer tutoring and oral presentations and practice analyses of research posters and writing samples from NMT graduate students.

After the initial training sessions, STEM Fellows receive much of their training through informal mentoring sessions. Steve Simpson and Julie Ford met regularly with the first generation of fellows to address questions and concerns from conferences or to discuss recent relevant publications. After the first generation of fellows was trained, new fellows were mentored by more experienced fellows. Steve Simpson and Julie Ford also coached STEM Fellows in performing needs analyses of their home departments, encouraging fellows to speak with and survey department heads, faculty, and students about departmental communication needs.

The first year, we concentrated on developing programs in three of the largest graduate programs on campus—Earth and Environmental Sciences (58 students), Mechanical Engineering (60 total students, including 33 distance students), and Physics (32 students). Drea Killingsworth, the Earth Sciences fellow, worked with her department head to pilot a one-credit writing seminar focused on students' thesis proposals. She also became the go-to person in her department for help working with ESL students. Rebecca Clemens, the Mechanical Engineering fellow, assisted Julie Ford with an engineering communication course and helped develop an in-house thesis template as well as style guides. She worked individually with students in the engineering communication course and consulted with distance students in the program. The Physics fellow started a student-run writing group and worked with a

faculty member piloting the new in-house graduate communication seminar. Along the way, fellows participated in other campus events. For example, Drea and Rebecca developed and delivered a series of three workshops on research posters, extended abstracts, and research presentations for the annual Student Research Symposium.

In the following sections, two of our STEM Fellows provide personal narratives of their experiences working in their home disciplines: Earth and Environmental Sciences (EES) and Mechanical Engineering. They recount their experiences wrestling with two vastly different departmental cultures and responding to additional needs that emerged while attempting to build community in their home departments. We then provide an assessment of our programs across all three of the initial disciplines: Earth Sciences, Mechanical Engineering, and Physics. Findings from the STEM Fellows' narratives and assessment data demonstrate different degrees of success as fellows wrestled with intricacies of the different departmental cultures. Findings also indicate the need for more structured mentoring opportunities between advanced and incoming graduate students, more focus on unstructured writing support over writing courses, and more development of asynchronous methods of peer interaction.

Building a Culture of Communication: Nuts and Bolts

Drea, Earth and Environmental Sciences (EES)

Initially, my involvement as a STEM Fellow with the Earth and Environmental Science (EES) department focused on working with ESL graduate students in the Writing and Oral Presentation Center (WOPC) to revise articles for publication. I worked with students to review the language, organization, and clarity of their writing. This process improved the language and writing skills of the ESL students and benefited advisors by allowing time to focus on content with their advisees. This background fostered awareness in EES of the benefits to both students and faculty of working with a WOPC tutor, causing the department to be receptive to the idea of developing student-run graduate writing initiatives. In the beginning stages, I recognized that students were likely sharing resources and collaborating within their small research groups. Earth sciences' emphasis on fieldwork fosters the development of working and social relationships that encourage interaction and community among students. Despite this interaction, a larger peer-network is needed to provide information about available resources for data analysis and access to writing groups.

Developing an In-House Proposal-Writing Seminar

I conceived of the one-credit Graduate Writing Seminar with the help of both my advisor and the EES department head, who were concerned about the level of tech-

nical writing skills possessed by existing and incoming students. First-year graduate students from both Hydrology and G^3 (Geology, Geochemistry and Geophysics) complete a research proposal by their second semester for the purposes of either procuring funding or forming a thesis committee. We developed this seminar to provide scheduled, weekly time for students to work on thesis-related projects. Eight students enrolled in the pilot seminar, divided equally between incoming and existing graduate students and between Hydrology and G^3.

The participating students provided an initial writing sample to both their advisor and me to serve as a baseline for evaluation. In a brief survey, students were asked to give a description of the project they intended to work on, to describe their current stage in their project, to set reasonable goals for the semester, and to discuss their comfort level with graduate-level technical writing. Four students set goals to complete drafts of National Science Foundation grant proposals. The remaining students worked on sections of their theses or thesis proposals.

An atmosphere of disconnection exists between Hydrology and G^3, as students from these two programs take different core classes, use specialized labs and facilities, and even attend separate department-sponsored social events. Within the department, international students commonly feel isolated due to language or cultural barriers, non-traditional students have difficulties assimilating because of a difference in age and real-world experience, and both students and advisors are absent for extended periods of time for fieldwork.

At the beginning of each meeting, we discussed what each student had accomplished during the week and addressed any problems or questions students had. The remainder of each meeting was used for students to work on their projects and to meet individually with me to review drafts. The interaction between small groups of students created a more relaxed and open environment that not only facilitated discussion but also allowed students to get to know each other on a personal level through casual conversation. This comfort level encouraged students to approach each other for help both in and outside of the classroom environment and to discover parallels between their work.

Every two to three weeks, we used the scheduled meeting time for peer review. I asked the students to bring printed two- to five-page copies of the sections they were each currently working on to exchange with another class member. I was also given a copy to monitor progress and improvement in individual writing skills. The weekly meetings and group discussion in the PPOHA-sponsored graduate lounge greatly facilitated positive interaction between students of different disciplines, years, and backgrounds. One of the advantages of working with students from specialized fields within the same broad discipline is the ability to use peer review to answer questions such as, "Is your writing clear to someone outside of your specific discipline?" Grant proposals are directed to a wide, scientifically-educated audience, making it important to explain discipline-specific terms, emphasize the

general relevance of the proposed project, and concisely describe detailed methodology. In the process of reading material aloud to another person, students evaluated their own work by listening to what they had written.

Common time and space resulted in the formation of mentorships between experienced and less-experienced students with similar fields of study. In two cases, students found a peer mentor within the seminar group. One incoming G^3 student was applying for funding from a grant that had been awarded to a current Hydrology student the previous year. This discovery made students realize that although the methodology of their individual research projects differs, the process of writing a proposal or thesis is similar. Although the second pair had different advisors and areas of focus, each used nearly the same methods to analyze samples in the geochronology lab. I asked the more-experienced student who was completing his master's thesis to work with the newer student on creating a template for a geochronology methods section. The more-experienced student gained insight into his own writing process by evaluating and teaching this process to others. The student being mentored benefited from seeing an example of how someone else had already organized similar material.

Mid-semester, I had the students use a discussion session to reevaluate and revise their project goals after they had more knowledge of the amount of work and time that goes into writing a thesis or proposal. Reevaluation allowed students to make more realistic plans for time management in the future, assess their resource needs, and recognize both their strengths and weaknesses throughout the writing process. Initially, one student had expressed that his previous project proposal was so heavily edited by his advisor that he no longer identified it as something he had written. Over the course of the seminar, he developed his "voice" by concentrating on only the methods section of his thesis. This focus allowed him to organize his data and improve his scientific writing skills through weekly revisions of a smaller volume of text. Eventually, he successfully presented his work to researchers, faculty, and students at the New Mexico Geological Society annual meeting, receiving high public praise from his advisor.

It was challenging to meet the different expectations of individual students. Despite the description communicated in the syllabus, incoming students were used to a more structured environment including lectures and regular assignments. The intent of this seminar was to provide a scheduled time during which students would be accountable to each other for making progress towards their writing goals. Graduate students are understandably overwhelmed by the daunting task of writing a proposal or thesis. This type of writing requires a longer time commitment, more in-depth knowledge of a highly-specific subject area, and more precise formatting than projects that students have previously completed. In many cases, students have the added pressure of being dependent on funding to continue their research. Part of the difficult transition into a graduate program is adapting to a

framework of self-sufficiency in finding resources, developing projects, monitoring progress, and staying motivated. Importantly, classroom collaboration resulted in the formation of a sustainable peer-network beyond the scope and duration of the seminar, through which students can now share technical resources for methodology, such as data processing and analysis, encourage each other to stay motivated, or just express their frustrations.

After the Seminar

After participating in the pilot EES Graduate Writing Seminar, many students from both Hydrology and G^3 attended the thesis boot camp and afterward formed an informal thesis writing group that met twice per week in the PPOHA-sponsored graduate lounge. These students have expanded upon the pilot seminar structure to include longer, less formal meetings and have encouraged membership from additional students from within the department. An unexpected outcome of this initiative was the ability to observe student interaction and identify individuals who had the passion and knowledge of their own writing processes to succeed me as the department STEM Fellow.

Rebecca, Mechanical Engineering (MENG)

When I began as a STEM Communication Fellow in summer 2012, I had no familiarity with the MENG graduate student culture, which primarily involves students performing independent research, interacting mostly with their advisor rather than other students, and focusing on writing only in the last semester of their two-year graduate program. I did not consider how these attitudes of independence and postponement would affect my plans to increase participation in graduate student peer communication groups.

Herding Cats: Peer Review Groups in Mechanical Engineering

My original plan for the Fall 2012 semester in the department was to create a bi-weekly peer writing review session for MENG graduate students. I informally surveyed several faculty members about the areas of student writing they felt needed most improvement. The most common response was "structure and organization," and "clearly defining their ideas and their work's significance." These surveys gave me a starting point for areas to focus on in the proposed group sessions.

An online scheduling survey was sent to all on-campus department graduate students to see if there was interest in a bi-weekly or monthly peer review session. Initially, five students indicated an interest either through the survey or personal communications. I set up a date and time to have a group meeting with the five students, asking them to bring several pages of their most recent writing. Two students

showed up; of the other three, one canceled prior to the meeting, and two simply didn't attend. This session was productive for the two who attended, so I tried scheduling a session for two weeks later. This time, no one came.

Trying to organize regular peer writing review sessions in the MENG department was problematic for several reasons. To begin, students tend to think they only need to take the communication in engineering course to develop good writing habits and skills. MENG students work independently on research, which carries over to their writing approach. Most MENG students have historically started writing the bulk of their thesis in their last semester, an attitude that reflects engineers' tendency to view communication products as an afterthought to technical work (Winsor, 1990). Students often consider the thesis itself to be peripheral to the main focus of their graduate school experience—their research work—and often comment that they aren't ready to write until they've completed all research, analyzed all data, and reviewed their conclusions with their advisor. Then, when they start writing, they feel they "don't have time" to spend on activities away from the computer (even ones that may help with their writing).

Further, the structure of the Mechanical Engineering program complicates the community building necessary for peer review groups and encourages students' natural inclinations toward working independently. The four MENG degree specializations (Explosives, Fluid and Thermal Sciences, Mechatronics Systems, and Solid Mechanics) require different core and elective classes, separating students into smaller, regularly interacting groups. Department laboratories are located in several buildings around campus, further segregating students. Each specialization has multiple advisors, and even if two students have the same advisor, each student's research differs, and he or she may interact regularly only with the advisor, not other students in the research group.

A Different Approach: The Communication for Engineers Course

My next approach was to work more directly with Julie Ford's Communication for Mechanical Engineers. I enrolled in this class myself in spring 2013 to fulfill one of my outside-the-department class requirements. This course allows students to use their own research work as the technical content for written and oral presentation assignments. All assignments are graded by Julie Ford and also peer-reviewed by classmates, which is a good introduction to the peer review process. Many students choose their thesis literature review as their major written assignment, and by the end of the semester they have a polished piece of writing to incorporate in their thesis. One interesting new assignment Ford added was a "Three Minute Speech," based on a competition at the University of Queensland (for more, see http://threeminutethesis.org/). Nine class members presented their research in front of an audience of NMT faculty, staff, and students, with only one static PowerPoint slide

and three minutes of presentation time. One of the audience members organizes the annual NMT Student Research Symposium (SRS), and was so interested and engaged that a Three Minute Speech category was added to the April 2014 SRS. Ford encouraged students to contact me (as a STEM Communication Fellow) outside of class, and some classmates did take advantage of the opportunity. I met several times with one student to help clarify his understanding of writing assignments and to work on his organization, flow, and grammar. I met with another student more than once to discuss the basics of literature reviews: finding and cataloging relevant literature, what information should be included, and how it should be organized. One drawback, however, was that most students assumed that the class is the only writing "group" they will need or want to participate in during their time in graduate school.

Building Community Remotely: The Distance Education Factor

One unexpected area of increasing participation in our programs is with Distance Education (DE) students, who often miss out on the opportunities to build community with peers on campus. New Mexico Tech offers Master of Science degrees in Science Teaching (MST) and Engineering Management that are conducted mostly or entirely as distance courses. All MENG graduate courses are offered online, as well, and, in fact, there are more distance MENG graduate students than resident students. In the Fall 2012 semester, a professor asked me to work with an Engineering Management student who was struggling with his report. The student emailed me his reports, and, over the next two weeks, two review sessions were conducted using Skype. Due to poor connection capability at the time, the Skype sessions were not very successful, and we switched to using the "track changes" and commenting features of Microsoft Word software, then emailing the updated versions back and forth. I have worked with several distance students since then, some from Engineering Management and some from MENG. I initially offer students the option of using Skype, but to date all have chosen the email and document "track changes" route. One student, working overseas in Afghanistan, found this method extremely helpful, as the time difference (10 hours) and his work schedule made it almost impossible for him to schedule live meetings. After several weeks of working together, he completed his thesis and submitted it to his committee. He successfully defended (by Skype) and has graduated.

There are several drawbacks to using email communication only: It is time consuming for the reviewer, as all comments and questions must be typed in; written comments or questions may be misinterpreted by the student as criticism, as it is hard to clearly indicate tone of voice and attitude in typing; and it limits the relationship that can develop between the student and reviewer even after several "sessions" are conducted. I worked, on and off, with one student for about 12 weeks, and had to repeatedly explain that I wasn't criticizing her approach or style

in my questions. In the future, I plan to offer only the Skype option to start with, as the connection quality has improved; this will provide clearer understanding of questions asked and comments made and allow us to develop a "face-to-face" relationship.

Reflections on my Time as a STEM Fellow

After my first year working as a STEM Fellow, six NMT MENG students went through the defense and graduation process during the Spring 2013 semester, four on-campus and two distance. Of those, three of the on-campus and one distance student contacted me for individual thesis review and feedback. Two of the on-campus students also engaged in informal peer review of each other's writing. I am a STEM Communications Fellow through the 2013-2014 academic year and am continuing to build community in my department, particularly in promoting the improved capabilities of the Writing Center's online assistance.

Program Assessment

As Drea and Rebecca discussed in their narratives, our STEM Communication Fellows program chalked up numerous successes in its first year. Departmental cultures can often be resistant to change, however, which has created numerous obstacles. In this section, we present some initial findings from our assessment of the STEM Communication Fellows Program and analyze the programs' effects to date. Assessment for the STEM Communication Fellows program is ongoing. Thus, assessment data included in this chapter are preliminary and focus on a small population—19 student respondents (of 21 enrolled) and 11 advisors (out of 12). Nonetheless, tentative findings shed an interesting light on our STEM Communication Fellows' personal observations and suggest directions for future program design in our own context and in others. All narrative and survey data collection in this study has been approved by our university's Institutional Review Board (IRB).

Program assessment consisted of follow-up surveys with students and advisors (administered via SurveyMonkey) and 30-minute follow-up interviews with select student participants from all three participating programs. Surveys utilized a "retrospective pre-post" design, an instrument used in educational research to account for "response shift bias"—that is, when respondents rank themselves higher on pre-tests before fully understanding what is being assessed (Moore & Tananis, 2009). Student participants were recruited from three initiatives: Drea's one-credit writing seminar, the graduate communication in engineering course with which Rebecca assisted, and the Physics writing group. In keeping with the "retrospective pre-post" survey protocol, student participants were given surveys after participating in the program and asked to rank their perception of their

communication abilities before and after participating in these initiatives on a scale of 1-5 (1 being "poor," 5 being "excellent"). Students were also asked their likelihood of soliciting feedback from peers before and after participating and were asked to indicate their likelihood of participating in other writing initiatives (e.g., writing groups, thesis and dissertation boot camp, communication courses, etc.). Advisors were asked to rate their students' communication abilities before and after participating in these initiatives. Last, students were contacted in the semester following their involvement in these activities for short follow-up interviews to elicit more nuanced responses on students' experiences and to see how many of the writing practices they learned continued with students after formally participating in a class or workshop.

Overwhelmingly, students and advisors indicated improvement in students' communication abilities, though interesting differences emerged among the three groups of students (Earth Science [EES], Physics [PHYS], and Mechanical Engineering [MENG)]). As seen in Table 7.1, EES students reported the most improvement in academic writing, moving from a 3.33 to a 4.42, an assessment echoed to some degree by faculty respondents. PHYS students noted no change in the surveys, though in the optional explanation box one indicated that it was simply "too early to tell." As we will see later, Physics students indicated other ways in which the initiatives helped. MENG students, as a whole, indicated some improvement (in most cases moving from a "3" to a "4", or a "4" to a "5"), though their self-reported skills were higher than EES students' and much higher than how MENG advisors ranked them. These rankings confirm what many of us observed: EES students seemed to be more aware than MENG students of what writing skills they needed. Further, and perhaps more interestingly, the EES student group consisted of both first- and second-year master's students, and the PHYS group consisted of doctoral students, some of whom have already participated in previous writing initiatives and have experience publishing. The MENG group consisted almost exclusively of first-year master's students, many of whom had only started working on their theses.

In addition to assessing student and advisor perceptions of growth in communication skills, we also assessed whether students participating in these initiatives were more likely to seek help from peers on writing, and whether they were inclined to continue participating in other Title V graduate writing programs. Students in all three programs identified being much more likely to seek out peer response after participating in these programs. Of 19 total respondents, 13 indicated that they "rarely" or "never" sought out peer response beforehand. However, 17 of 19 students indicated that after participating in these initiatives they would "definitely" (8) or "probably" (9) seek out peer assistance. All seven mechanical engineer respondents indicated that they would "definitely" (1) or "probably" (6) seek peer assistance.

Table 7.1. Student and advisor rating of communication skills before and after participating in STEM Communication Fellows initiatives

Participants	Ratings (Number of Responses)					Rating average
	1	2	3	4	5	
All Students (n=19)						
Before	0	0	10	9	1	3.47
After	0	0	1	15	3	4.11
EES (n=9)						
Before	0	0	6	3	0	3.33
After	0	0	0	8	1	4.11
MENG (n=7)						
Before	0	0	3	4	0	3.57
After	0	0	0	5	2	4.28
PHYS (n=3)						
Before	0	0	1	2	0	3.67
After	0	0	1	2	0	3.67
All Advisors						
Before	0	3	4	2	0	2.89
After	0	1	3	4	2	3.70
EES (n=4)						
Before	0	1	1	1	0	3.00
After	0	0	1	2	1	4.00
MENG (n=5)						
Before	0	2	2	0	0	2.50
After	0	1	1	2	0	3.25
PHYS (n=2)						
Before	0	0	1	1	0	3.50
After	0	0	1	0	1	4.00

However, these groups diverged in their responses to participating in future initiatives. EES and PHYS students were emphatic in their wish to participate in boot camp (8 of 12 were "definitely," 2 were "probably") and writing groups (4 "definitely," 6 "probably"). MENG students were much more noncommittal, 6 of 7 indicating that they would "maybe" participate in a writing group, 4 of 7 indicating

that they would "maybe" participate in boot camp. Thus, at least as far as the survey responses are concerned, most of the 19 students developed good impressions of peer feedback. MENG students, while in theory more receptive to the notion of peer response, were reluctant to participate in any of the formal mechanisms created through our graduate program design.

The follow-up interviews shed more light on the dynamics of student interaction within these initiatives and how the programs evolved to better fit the diverse departmental cultures. In particular, these interviews revealed quite a bit of activity in the Physics writing group despite participants' hesitance to indicate improvement over the semester. In the fall 2010 and spring 2011, Steve Simpson had partnered with a physics professor to help physics students set up student writing groups with little success, mostly because students had trouble finding common meeting times. The Physics STEM Communication Fellow had more success, as he adopted a more flexible plan that did not require synchronous meetings. One participant described the setup as such:

> It was pretty casual. It was a group of about five or six of us who all expressed an interest in not only improving our writing but helping others to improve theirs. When we started out, we sort of met in person, and we tried to figure out a good online way to pass the information, and we settled on Google Drive, which has been pretty useful for this purpose.

In most cases, participants explained, the group would email each other when they needed feedback and upload the document to Google Drive. Participants mostly provided comments using either the Google or Word commenting features. Participants wanting to provide further explanation on comments would stop by the writer's office or lab and provide extra explanation if necessary. In some cases, such as when members of the group were preparing research posters for a regional American Physical Society meeting, the group arranged a physical meeting time. Otherwise, most feedback was given asynchronously.

As participants explained in interviews, the informal nature of the writing group worked in this case, as many of them had common deadlines, which provided incentive to work together:

> Actually, [name removed] and I helped each other on the New Mexico Space Grant. She asked if the writing group would review hers. I go, "Oh, this is a good idea." If there's a bunch of essays and proposals of your research they go, "Yeah, I'll send you myself then too." I think it's just because in our department everyone's schedules are so different. I know other departments are the same. It seems that when there was a writing sort of, task

> that we all had to do because we're all in the same kind of, field we're all sort of, focused then.

More significantly, starting the writing group through the STEM Communication Fellow helped provide a forum for students who wanted such assistance but felt awkward about initiating such contact, as one participant explained:

> For me, the hard part was initially asking for other students to help me review. That's why the student writing group was perfect because now there was a small subset of my classmates that I knew I could go to ask for that help.

As with the physics writing group, the EES seminar was informally constructed and catered to students' different schedules. Perhaps more interesting, however, was the unique blend of students from both G^3 (geology, geophysics, and geochemistry) and Hydrology backgrounds, as Drea explained earlier, and the mix of beginning and advanced students in the program. In follow-up interviews, one of the more advanced students indicated that he joined the seminar specifically because it gave him an opportunity to share his knowledge with incoming students;

In other words, both departments had students who were more naturally inclined to provide peer feedback but did not have formal mechanisms through which to do so. In this sense, the initiatives "got the ball rolling," creating precedent for future peer partnerships. This opportunity benefited some of the newer students in the class. One such student admitted in an interview that she was so new to the field and to the research process that she hardly had anything to write for the first part of the class. Much of this time was spent observing more advanced students talk about their writing. Thus, by the time she got around to working on her own writing (a short NSF grant proposal), she felt that she had some direction.

Discussion

The goal of our STEM Communication Fellows program is to take positive steps toward developing a more pervasive, large-scale culture of communication in our graduate programs on campus and to develop more community among graduate students. Naturally, institutional contexts vary widely. While our particular program design might not transfer directly to other institutions, we believe that our thought processes might be useful to other WAC/WID program administrators developing similar initiatives elsewhere.

As seen in both our STEM Fellow narratives and our assessment data, we experienced different degrees of success across the three departments with which we worked. Our EES and Physics STEM Fellows experienced reasonable success

developing more informal, peer-based writing support mechanisms within their departments. While Rebecca made significant headway in Mechanical Engineering—particularly in support for distance students—she reported some difficulties getting students to commit to writing groups outside the confines of a class. Numerous factors account for her experiences with these students, some of which are simply out of her control (e.g., some students simply have numerous work or family obligations to balance with school work). Further, both Julie Ford and Rebecca Clemens have noted in their interactions with MENG students that they tend to be more focused on their core coursework and more independent-minded than other students at New Mexico Tech.

However, as Julie Ford reported reflecting on these experiences, other contributing factors might be addressed more easily. Ford mentioned that many of the graduate students in the Mechanical Engineering program also completed undergraduate degrees at New Mexico Tech (unlike the vast majority of students in EES and Physics) and had already taken a required undergraduate technical communication course in addition to the graduate-level Communication for Mechanical Engineers, which many advisors strongly recommend. Thus, some students might have developed the impression that they had "their bases covered" in terms of communication, rather than seeing writing as something to address throughout their graduate and professional careers. Further, as noted earlier, the MENG students who participated all tended to be first-year students, as opposed to the PHYS writing group, comprised exclusively of upper-level students, and the EES initiatives, which included a mixture of first-year and advanced students. Quite possibly, the first-year students were not as aware of what writing skills they would need as they progress toward the thesis and did not have the benefit of interacting with more advanced students within the context of the class who could alert them to these needs.

These findings have several important implications for program design. First, they underscore the importance of facilitating conversation among beginning and upper-level students in graduate programs. Our initial program designs with the Title V grant focused almost exclusively on acculturating and retaining new graduate students, an ill-fitting hold-over from many retention efforts at the undergraduate level. In graduate program design, we must consider that students will have a variety of needs at different levels of their academic progress, and many graduate students might not fully appreciate the complexity of graduate-level writing until they are at the thesis-writing stage. Further, facilitating discussion on writing between advanced and beginning students builds an architecture of apprenticeship into the program, wherein more advanced students are given opportunities to share their knowledge with newcomers. Not only is such student-centered design potentially more sustainable, but it is potentially more persuasive to graduate students, who might be more resistant to support mechanisms that seem to be imposed on them from faculty. To an extent, we saw this phenomenon in the Physics

Department initiative, where a student-initiated writing group experienced more success than previous attempts at faculty-initiated groups. Second, these findings emphasize the importance of coupling graduate-level classes with other forms of support. Drea Killingsworth, in her writing seminar, established a link with the thesis boot camp from the start: students were generating proposals of projects they would later work on in boot camp. And, in fact, four of the students with whom she worked participated in boot camp afterward. The Communication for Mechanical Engineers graduate course filled a critical need in that department, though Ford, upon reflection, indicated the need to better emphasize the need for further forms of support beyond the class.

Further, these findings raise questions about how and when one attempts to change a local department culture. On the one hand, program designs that fail to account for local student attitudes are naturally limited in their potential effectiveness; in fact, these elements of local department cultures can often be harnessed in useful ways. For example, our MENG students, while extraordinarily independent-minded, are also competitive. Thus, Ford experienced great success with a "3-minute speech" competition with cash prizes in her communication course. On the other hand, one cannot just assume that departmental cultures are immutable. The rift between G^3 and Hydrology students that Drea recognized in the EES program is long-standing and stubborn, but students from these programs can benefit from more interaction with each other. Similarly, many professors in the Mechanical Engineering program would attest that the students—and the department—would benefit from more peer collaboration, particularly since peer collaboration is an essential component of one's future professional life in engineering. Meeting this type of resistance means that more efforts are needed to demonstrate the value such programs might have for them.

As indicated earlier, a central focus of our Title V programs has been to create better community and peer mentoring among graduate students. Our program design efforts, however, have required us to challenge our assumptions of what "community" entails. Our initial program designs assumed much more face-to-face interaction among graduate students. Graduate students' lives, however, are complex, and giving our STEM Fellows the reins to partake in the program design afforded them the opportunity to show faculty what forms of community might better suit their needs. In the case of Physics students, the community that developed was almost entirely online and asynchronous. In Rebecca Clemens' experiences with DE students, the community that she developed had to be online and, in some cases, asynchronous. Drea's course design included a mixture of face-to-face and online interactions. Some of the ESL students with whom Drea has worked have preferred face-to-face interactions, though other students preferred other means.

After the conclusion of the PPOHA grant in 2014, the STEM Communication Fellows program was sustained by linking it with a quarter-time graduate

student minority scholarship through the Center for Graduate Studies. Students become STEM Fellows through a competitive application process which has afforded the position an unexpected prestige among graduate students on campus.

Epilogue: An Incoming Writing Center Director Reflects on the STEM Communication Fellows Program

Jesse Priest

Reading about the challenges and rewards of developing the STEM Fellows program at its inception is humbling and inspiring. As a new director, I have inherited a program that now, a few years later, seems like an obvious and organic part of the NMT Writing Center environment. WPAs and WAC coordinators would do well to continually investigate institutional histories and contexts as a constant reminder of what Jackie Grutsch McKinney (2013) calls "the material realities of our centers" (p. 36). In doing so, as this chapter has reminded me, I can see the STEM Communications Fellows program as *not* obvious and organic, but rather an institution full of the history of individuals who designed it as a response to specific contextual needs. As an incoming director, I can make a few observations to update readers on the progress of the STEM Communications Fellows program a few academic years into its growth.

During last academic year, the Writing and Oral Presentation Center tutored an average of 130 unique student visitors each semester, with graduate students accounting for nearly 25 percent of our tutees. By New Mexico Tech standards, this means we are now tutoring more graduate students per semester than the WOPC was seeing for total student visitors in 2005. As an incoming director, it is easy to see the crucial role the STEM Communications Fellows program has played in that expansion and will continue to have as we expand even further.

The original authors of the *Across the Disciplines* article (Simpson et al., 2015) cited the continual need to "identify graduate writers' specific needs and to develop writing resources tailored to these needs," (p. 1) and I believe the STEM Communications Fellows program has grown into a practical realization of this earlier call. For a new director, the STEM Fellows provided me with de facto assistant directors: engaged graduate tutors who came qualified to combine burgeoning disciplinary expertise with graduate student writers' perspectives. The variety of STEM Communications Fellows I have already worked with—including graduate students from Materials Engineering, Biology, Mineral Engineering, and Chemistry—has given me an apparatus for campus outreach and understanding different departments' faculty and graduate student needs. For a now returning director entering my second year, the STEM Communications Fellows continue to provide

me with a finger on the pulse of different departments each semester, keeping my perspective fresh and aware of changing needs. I am a firm believer in Writing Program Administration that seeks to create sustainable institutions that do not rely on one individual director's vision to function, and the STEM Communications Fellows program models that kind of sustainability.

Including individual students' voices in the institutional histories of our writing centers and WAC programs is an ongoing necessity. The resonance of these voices exists regardless of whether we recognize them or not: Drea's earlier observation that graduate students' two "primary difficulties" are finding resources and knowing how to begin writing, hold true today and is clearly a part of the pedagogical onus behind the STEM Communications Fellows program that I inherited. Similarly, both Drea and Rebecca comment on students struggling with expectations of linear writing processes or separations between thesis-writing and research in similar ways that our current Biology STEM Fellow reflects on how working as a STEM Communications Fellow has improved her own writing process:

> I would say my biggest accomplishment as a STEM Fellow was broadening my teaching skills by learning to listen to what a student expects from a tutoring session at the Writing Center. This helps guide the rest of the session and makes the session more valuable to both parties involved. Additionally, it was important to learn that it is okay to have limitations set for your session, for example, going through X pages of a thesis together rather than a whole thesis in a one hour session.

This reflection resonates with Mary Jane Curry's (2016) observation that graduate students benefit from "speaking with an authorial voice" (p. 87) in their transition from knowledge receivers to knowledge producers. Being a STEM Communications Fellow allows graduate students to inhabit roles of authority concurrently with their process of becoming experts in their own disciplines.

The WOPC and the STEM Communications Fellows continue to have an expanding role in the Student Research Symposium, a connection which I now know can be at least partially traced back to Julie Ford piloting a new assignment in her 2013 Communication for Mechanical Engineers course that Rebecca took part in. Our Biology STEM Fellow this year helped redesign the Student Research Symposium presentation templates, an initiative that she pioneered, which I am going to make an annual part of the STEM Communications Fellows' involvement with the SRS.

We continue to work on developing reliable modes of assessing graduate students' experiences. Currently, our STEM Communications Fellows perform weekly check-ins and an informal exit interview with me, which I am working on formalizing to help me design training and professional development for future

STEM Communications Fellows. In doing so, I seek to experiment with program design that fosters intersections across success and retention initiatives on campus. The STEM Communications Fellows and similar programs foreground individual graduate student experiences within program development and help directors and other WPAs create historically-aware institutions.

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