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5-2015

Engineer as Writer and Woman: Gender, Identity, and Professional Discourse

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A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy in English

by

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May 2015
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Abstract

As students, academics, and professionals, women entering engineering disciplines still encounter barriers that may impede their success. In this environment, what is the role of writing in the development of a professional identity, and how does it function as an avenue or a barrier to professional success? Using an ethnographically-informed case study approach, this dissertation focuses on the experiences of three women—a biological engineering student, an industrial engineering academic researcher, and a civil engineering professional—to examine how these women use writing to construct an engineering identity, take action within their discourse communities, and to demonstrate their technical expertise and ability. Yet even for these highly skilled women, writing does not always lead to professional recognition and advancement. While writing might serve as a potential tool to recruit and retain women in engineering fields, the drawbacks to being a good writer in engineering must be understood in the continued pursuit of equity. Finally, this dissertation examines the traits these women possess that enable them to be skilled writers, and how those features could be incorporated into writing pedagogy. Writing is an essential component of what it means to be a skilled engineer in a variety of settings, and women's personal and educational backgrounds are a component of that ability. By understanding the three women's experiences as engineers and writers, future research can build on these findings to learn how use writing as a way to achieve equity in the field, how writing aids in the development of a professional identity, and how to continue to enhance writing education.

Acknowledgements

A special thanks to the three incredible women who willing shared their expertise, stories, and time with me—without their generosity this dissertation would not have been possible. An additional special thanks goes to David Jolliffe, who first brought up the idea of researching women in engineering and helped me develop a feasible project, and to Mya Poe for agreeing to serve as an outside reader as well as for her feedback and support.

Dedication

        To the women fighting the good fight in science, engineering, or any path, male-dominated or otherwise—don't let anyone tell you that you can't.

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Introduction

As someone whose education is primarily in the liberal arts, I never thought I would find myself surrounded by engineers and scientists both personally and professionally. I was never alienated by their supposedly different "culture" or worldview, however, and I discovered that we often shared common interests in art and in science. In fact, while employed in first the civil engineering department and later the engineering college dean's office, I often discussed writing with the engineering professors and educators with whom I had frequent contact. Contrary to stereotypes, I found these men and women to be committed to developing their students' writing skills, and they would often ask my opinion on the topic of *why can't these students write?* I began to examine that question and learned that while many students do indeed struggle to write appropriately for engineering contexts, it's not always that they lack the skills or the composition courses but that they are unable to grasp the unique demands of engineering discourse.

And for all the individuals who struggled, I also encountered those who rose to the challenges before them, demonstrating their commitment to effective communication. These individuals were students, professors, professional engineers, researchers, and educators: they cared about writing, and they did it well. I grew curious about what set them apart—what enabled them to write successfully when their colleagues or peers might struggle? The more I talked to these skilled individuals, the more I become uncomfortable with the blanket stereotype, often perpetrated by engineers and scientists themselves, that technical communication in science, technology, engineering, and mathematics (STEM) was boring, incomprehensible, and poorly written. It is certainly true that technical and professional communication differs from writing one might find in more humanistic disciplines, yet it is problematic to evaluate technical writing by those standards. As research in technical writing demonstrates, those texts are the

product of complex social factors; as scholars in the rhetoric of science argue, it is the result of a paradox in which STEM writers must construct a reality where it appears that nothing at all is constructed. In other words, there is an art to writing in such a way as to be read as simply conveying truth or realities freed from rhetorical devices, while all the while employing rhetoric to accomplish those goals.

It was in this multi-faceted world I found myself teaching and researching, determined to improve the writing education of STEM students through composition courses that focused specifically on scientific discourse. Simultaneously, I was growing aware not only of a subfield of composition—*feminist composition*—but also the plight of women in STEM fields. I began to talk to women who were engineers, professors, scientific researchers, or graduate students who shared not only their awareness of the distinct features of scientific discourse but also their experiences as women in a male-dominated world. I became interested in learning what it was that women possessed that enabled them to write so well within STEM as well as the ways writing might impede their professional success. As feminist critiques of science have continuously pointed out, scientific research is often based on the notion that focusing on male subjects leads to results that are generalizable (Bleier, 1986; Schiebinger, 2008). This assumption, especially where it concerns research in areas where women are underrepresented, leads to an erasure of the women who exist in those spaces. It also promotes men as the norm and male experience as the only experience that matters; women are thus positioned as outside this norm or forced to conform to it. One of my goals, then, was to undermine this notion and focus on women in engineering, particularly the ways they use writing.

Women in Engineering

Women have long faced disadvantages when they attempt to pursue careers in STEM fields. Numerous researchers have examined the disparities in women's participation in STEM, many offering potential solutions to encourage women to enter and remain in the field. In *Women and Minorities in Science, Technology, Engineering and Mathematics: Upping the Numbers*, edited by Ronald Burke and Mary Mattis (2007), the contributors explore the barriers that prevent women from entering the field, what pushes them out (the leaky pipeline), and what factors enable them to persist in STEM. Burke (2007) begins the volume by arguing that with technological advances, developed countries such as the U.S. need skilled, educated workers, yet we are facing a shortage that is exacerbated by the barriers preventing women and minorities from entering the field. As he comments, "Women students can cope with the engineering work, but not with the engineering culture" (Burke, 2007, p. 9); this hostile culture reduces the pool of qualified individuals and the diversity that can lead to innovation. Burke (2007) offers an overview of measures that can be used to recruit girls in elementary and high school in order to create a more welcoming environment at the university level and provide professional support and development through governmental programs such as the NSF ADVANCE initiative that would enable women to advance and succeed professionally.

Other contributors go into greater detail about different aspects of these themes. Donna Dean and Anne Fleckenstein (2007) discuss what assists women's success, including calling attention to subtle gender biases that influence how institutions perceive women in order to correct them and providing mentors to women. As they indicate, mentoring is crucial to success: "In addition to helping to recruit and retain women scientists, mentoring has been associated with higher income, greater self-esteem and creativity, and higher levels of job satisfaction"

(Dean & Fleckenstein, 2007, p. 40). Susan Staffin Metz (2007) also examines methods to interest female students in engineering by telling a different "story" because women are more likely to enter engineering if it is presented as contributing to a better quality of life for individuals or as having wide-ranging social impacts. While this generalization obviously points to stereotypes about women being interested in "helping" professions, Metz (2007) urges re-conceptualizing the "negative and extremely limiting" (p. 193) cultural images of the masculine engineer, focusing on social and institutional transformation. Xiangfen Liang and Diana Bilimoria (2007) also explore problems of representation and the experience of women in academia, citing the hostile environment and isolation women frequently face that "derails large numbers of women from having successful long-term careers" (p. 322) as well as a lack of resources, since "women faculty receive less office and lab space, have less access to graduate student assistance, and get fewer services from support staff" (p. 323). In the final chapter, Mary Mattis (2007) discusses the "erosion" of the progress made by women in engineering fields, arguing that it is not women's abilities that prevent them from entering engineering—other math-based fields have actually seen significant increases—but the masculine culture that prevents women from pursuing degrees. She analyzes several initiatives aimed once again at institutional change rather than individuals, indicating that these initiatives are promising and that more are needed to create a fully welcoming environment for women (Mattis, 2007). The essays in this collection are consistent with other work that strives for institutional change in order to improve the working conditions of women in STEM fields (Stewart, Malley, & LaVaque-Manty, 2007).

The Rhetoric of Science

Given its emphasis on writing, the rhetoric of science and composition studies provide theoretical orientations for my study. In the oft-cited, occasionally misapplied *Structure of*

Scientific Revolutions, Thomas Kuhn (1962/2012) argues that scientists approach scientific knowledge through paradigms, which are subject to shifts when old methodologies or perspectives no longer work to solve the problems within a particular discipline. He offers an argument that works to dismantle positivistic notions of science as purely objective, of scientific knowledge as being generated linearly and constantly progressing from one discovery to the next (Kuhn, 1962/2012). The picture he instead presents is one of a messy, human process of discovery, where we must always make interpretations of observations based on our perspectives and biases and favored theories rather than an objective pursuit of absolute truth—in other words, a rhetorically-conscious view of science.

While criticizes Kuhn's arguments, Alan Gross's (1996) *Rhetoric of Science* also outlines how scientists employ rhetoric in their approaches to science and the writing they construct. Essentially, the rhetoric of science as a discipline examines the argumentative nature of science, a concept that STEM workers often find troubling—or reject outright—given the emphasis on clarity, objectivity, and evidence that is intended to reflect a knowable reality rather than an interpretation of findings. Gross (1996) argues that by understanding "the creation of knowledge [as] a task beginning with self-persuasion and ending with the persuasion of others," science is removed from its elevated status, and it "may be progressively revealed not as the privileged route to certain knowledge but as another intellectual enterprise, an activity that takes its place beside, but not above, philosophy, literary criticism, history, and rhetoric itself" (p. 3). He is particularly interested in the ways that scientific knowledge is so persuasive that it becomes seemingly arhetorical, or a simple reflection of reality, which he asserts is a perception that the rhetoric of science must dismantle (Gross, 1996). As he concludes,

> When scientific truth is seen as a consensus concerning the coherence of a range of
> utterances, rather than the fit between the facts and reality, conceptual change need no

longer be justified on the basis of its closer approximation to that reality. It is instead the natural result of the persuasive process that is science, a persistent effort to renew consensus despite a constant influx of potentially disruptive utterances. (p. 204)

By understanding the rhetorical nature of science, researchers can thus examine the ways culture influences and affects the production of scientific text, theories clearly relevant to this dissertation.

It is this disciplinary edge that also informs the work of Bernadette Longo (2000) and Leah Ceccarelli (2001), an edge that I also address. In *Spurious Coin: A History of Science, Management, and Technical Writing*, Longo (2000) examines the historical tensions between the sciences and the humanities by tracing the rise of technical writing, which was and often still is based in the humanities. She uses the metaphor of coins to explore how scientific knowledge is valued as legitimate currency, yet technical writing represents a spurious or counterfeit form of currency, leading to conflict between the two disciplines over who has power. Also exploring divisions between disciplines, Ceccarelli (2001) examines how scientists both successfully and unsuccessfully negotiate disciplinary boundaries to address multiple audiences through a single text. She uses the terms *conceptual chiasmus*, "a rhetorical strategy that reverses disciplinary expectations surrounding conceptual categories, often through metaphor, to promote the parallel crisscrossing of intellectual space" (p. 5), and *polysemy*, a rhetorical strategy that enables a text to be read differently by different audiences (Ceccarelli, 2001). Her discussion resonates with a study that strives to blur disciplinary boundaries as well as examine the ways texts can simultaneously address multiple audiences.

In addition to these two works, much has been published examining engineering and technical writing that will be relevant to this study. Two works in particular are Dorothy Winsor's *Writing Like an Engineer* (1996) and *Writing Power: Communication Within an*

Engineering Center (2003). While I critique both texts for their exclusion of women and their inattention to gender concerns, both serve to examine engineering writing at the undergraduate academic and professional level. In *Writing Like an Engineer*, Winsor (1996) conducts a longitudinal study of four engineering students, collecting writing samples and interviewing them throughout their formal education and internship experiences. Using this wealth of data, she is able to analyze the ways engineering students acquire writing skills as well as their enculturation into the engineering profession (Winsor, 1996). In *Writing Power*, she extends this work, focusing on the written genres and the ways those genres operate on different levels in an institutional hierarchy, serving to create and reinforce power relationships and organizational structure (Winsor, 2003). These studies are both notable in their thoroughness and insight into the role writing plays in the education and work of engineering and represent the foundation for subsequent work that examines engineering communication.

Feminist Science, Feminist Composition

Given my particular focus on women in STEM, theories that have emerged from feminist science and feminist composition are part of this study's backdrop. Feminist science is a field of inquiry that strives to critique scientific practice as well as recover the important contributions that women have made to science. For example, in *Science and Gender*, an early text that addresses the problem of male bias in scientific inquiry, Ruth Bleier (1984) takes on E.O. Wilson's sociobiology along with several related theories that promote claims about the biological basis of gender differences.[1] Bleier's (1984) argument is in line with work in the rhetoric of science as she examines the ways the sociobiologists argue, call on cultural notions of gender, and persuade audiences to accept their ultimately flawed claims based on deeply

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[1] Although Bleier's book is nearly thirty years old, the concept of a biological basis for gender differences is still troublingly relevant with regard to scientific research; in fact, Cordelia Fine's *Delusions of Gender* (2010) is an extension and update of Bleier's argument, targeted to a more general audience unlike Bleier's more academic text.

problematic research. She is thus concerned with the ways cultural bias can blind scientists in their research and interpretation of data either through personal and emotional investment in their own ideas as well as their position as human beings within a society. These same scientists then present research that seems to indicate that women are biologically predetermined to be and act in certain ways, research that neglects its cultural context, research that continues to contribute to the underrepresentation of women in STEM fields (Bleier, 1984). Other work within feminist science extends this critique, exposing the unquestioned masculine biases that are prevalent within the history and culture of science and the effects they have on scientific research and the inclusion of women (Schiebinger, 2008; Watts, 2007).

Additionally, scholars have engaged in applying feminist theory to composition studies to examine the connections among gender, experience, and the teaching and learning of writing. With the second wave of feminism and the rise of the French feminist school of thought, some researchers became interested in the idea that women write differently than men due to their gender, establishing men's writing as the norm and women's writing as varying from that norm. For instance, Mary P. Hiatt (1978/2003) examines how despite strongly held beliefs that men and women use distinct styles, her analysis of men's and women's texts find that they do not differ in any commonly believed way, although "The emergence of specific differences between the two groups of writers does…lend valid support to the theory that types of styles or styles characteristic of groups of writers do exist" (p. 45). It seems that the strongly held belief that masculine styles differ widely from feminine styles is one that is difficult to dismiss, and subsequent scholars wrestle with what it means to write as a woman, sometimes analyzing student writing from this gendered perspective, leading to charges of essentialism.

To address some of these issues about masculine/feminine characteristics and the ways readers perceive and assess the writing of men and women, Janis Haswell and Richard Haswell (1995; 1996) use empirical research methods to pursue an understanding of how one reads gender into an androgynous text and how that gender reading affects reader criticism. Their findings demonstrate that when the writer's gender is unknown, a reader assigns one (though they are incorrect roughly half the time) and bases his/her assessment on what Haswell and Haswell (1995) call gendership to conceptualize "the image of the writer's sex interpretable from text and context" (p. 226). Their work has clear implications about the possibility for misreading student work based on a misreading of gender, or of the dangers of more harshly criticizing student work when a writer is seen to cross gender boundaries. Their work complicates the notion that a writer's gender is clearly identifiable within a written text and exposes the problems of gender-based (or gender-biased) assessment.

Engineer as Writer and Woman

Grounded in theories from the rhetoric of science, composition studies, and feminism, this dissertation explores the intersections of women's experiences both as women and engineers. In Chapter 1, "Writing Women into Engineering," I argue that not only should scholarship in STEM writing, particularly in engineering, focus more on women to correct the oversight in current research, but women's educational experiences may enable them to enter engineering as stronger writers. In this chapter, I also introduce the three participants—Katy, the professional civil engineer; Christine, the academic industrial engineer; and Emma, the student biological engineer—and outline the methodology used to approach the primary questions of this study.

Subsequently, Chapter 2, "Engineering a Writer Identity," explores the question of an engineer's writer identity, and what that identity enables these women to accomplish with their writing. Although two of the participants were hesitant to proclaim themselves as "writers," their awareness of genre and how it can be used to accomplish action is connected to their ability to integrate both the *writer* and the *engineer* into their professional identity. I link their genre awareness and subsequent writer identity formation to their experiences as women, arguing that gendered experiences may encourage women to pay more attention to the action genres can accomplish.

Because of their genre awareness and their writer identities, these women are able to use writing to elevate their status in engineering, the focus of Chapter 3, "Patching the Leaky Pipeline: Writing and Professional Success." The participants revealed several characteristics that set them apart as writers: an ability to account for audience, their willingness to write in more detail about elements that mattered, and their strong work ethic, which did not allow them to dismiss their writing as less vital to their engineering work. Their skill and work ethic earned these women awards and recognition, facilitating their success within their professional communities.

Unfortunately, writing is not unequivocally a gateway for women's success in engineering, a situation I explore in Chapter 4, "Blocking the Pipeline: Gender and Writing as Barriers to Success." For much of its history, technical writing was seen as disconnected from the "real" work of engineering, a requirement that could potentially be outsourced to technical writers. This division between written and engineering labor was perpetrated by stereotypes that women were better equipped to produce texts while men were more capable of field work. The lingering hierarchization in engineering fields means that if women are associated with textual

production, their labor is potentially less valued than men's association with design and data, marking success in writing as problematic. In fact, despite its potential use to earn professional status, writing might also function as a gatekeeper to prevent women's advancement.

Finally, given my use of a composition studies perspective in Chapter 5, "Genre Awareness, Mentorship, and Reflection: Paths to Writing Success," I argue that these women's experiences might point the way for more effective writing education for both male and female engineering students. All three women made use of their genre awareness, their mentors and models, and their opportunities to reflect on writing experiences to increase their metacognitive awareness of engineering writing and how to write successfully. This chapter focuses primarily on the experiences of Emma, the student engineer, as she used these tools to develop as a writer over the course of the semester that we worked together.

The problems women in STEM face are due to the complex interplay of a variety of factors, and this study is concerned with the function of writing within that context. If writing offers both possibilities and pitfalls to women, then a greater understanding of this nature may enable women to use writing to gain success while preventing it from blocking their progress. Additionally, research in technical composition must account for the presence of women in STEM because research that only examines male experience risks perpetrating the status quo of STEM as men's work. Women may not write fundamentally differently because of their gender, but their minority position within engineering does affect their experience of engineering and their socialization in professional communities, which will impact the writing they produce. In the end, it is my hope that I can share these three women's narratives of writing with a broader audience to call attention to their distinct experiences, and that we can build on their stories as we continue to pursue greater equity for women in STEM disciplines.

Chapter 1

Writing Women into Engineering

As I entered the offices of the small civil engineering consulting firm where I would be observing Katy for the first time, what I was first struck by was the sheer amount of *text*. As Katy gave me a tour of the building, at every turn we were confronted by bookcases full of binders stuffed with paper, survey notebooks, design plans, handbooks, and manuals. In some places were boxes filled with documents that did not have a permanent home from when the firm moved into its current office, so they sat piled on the floor, half-forgotten. Katy's desk was covered with stacked manuals and engineering graph paper, and she was surrounded by previous reports, her manuals and textbooks, and other forms of text. Her direct supervisor and mentor's office was even worse, with every spare inch of his desk a mass of paper, with stacks scattered around the floor of his office. Text dominated the physical space of the engineering firm in a way that was both surprising, yet expected. It struck me then how mediated by text was the work of engineering, how large a role writing plays, and yet how frequently writing can be dismissed or ignored when thinking about the engineering profession or even when teaching aspiring engineers what they need to know.

While it took some time to be able to meet with Christine, an active industrial engineering researcher and leader in the academy, I was struck by the similarities between professionals in two very different lines of work. Christine's office was tidy—perhaps evidence of its somewhat more public nature—yet text too filled the space. On a table lay a spread of glossy annual reports, representing the work of a research center that Christine leads, which she pointed me to when I asked about the range of writing she does. Most central to the office is the computer, however, where emails and files are stored that represent the bulk of the text Christine

produces. All over the office were signs of an active researcher, writer, administrator; Christine takes on many roles within the academy, and text mediates these activities and is produced through them. Since Christine is an academic engineer, I fully expected her primary forms of writing to be journal articles and research proposals, but instead I learned that she actually spends more time writing administrative documents and working with her students' writing. Like Katy, text dominates her professional life.

A sophomore-level biological engineering student, Emma seemed excited to talk to me about writing, but also a little nervous: was the writing she spends so much time doing worth my attention? She sent me samples of her writing, keenly aware that it didn't represent "real engineering" writing, and she wondered if perhaps she would not be a good subject for a study on the writing practices of women engineers. As a novice engineer as well as engaged citizen and student, Emma writes to accomplish tasks and achieve her goals, yet she is all too aware that there is much more she needs to learn about the writing she will do as an engineer after graduation. Once again, I was struck by the amount of writing she produces and the range of genres she has to use. As with all three engineering women, writing seemed to play a key role in Emma's professional and personal identity, despite stereotypes of engineers as poor writers and communicators, as workers who only write because they must.

Women and the Writing of Engineering

While they come from three different engineering disciplines and are at three different levels of professionalization, Katy, Christine, and Emma share a strong interest in writing, a love of reading, and a metacognitive awareness[2] of the elements of effective writing. They also all

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[2] It's possible that what I term "metacognitive" may also be read as "metadiscursive" because of the participants' consciousness of both their own thinking as well as features of their writing particular to their social context, engineering. Jonathan Culpepper and Michael Haugh (2014) offer a discussion of various kinds of what they refer to as metapragmatic awareness or forms of reflexive awareness: metacognitive, metarepresentational, and

have clear opinions about themselves as writers and about the characteristics of good writing. With each of these three women, I was intrigued when they spoke of writing in theoretical ways, making comments about style, voice, audience; both Katy and Emma discussed at length how they shift their writing to accommodate specific audiences, and Christine was keenly aware of the distinctions among the variety of texts she both produces and consumes. Despite their different backgrounds, engineering disciplines, and professional accomplishments, each held sophisticated ideas about writing: they were getting at theoretical concepts of writing that composition scholars explore, yet the literature would suggest that engineers generally are unaware of, even if they're able to use them skillfully. With every conversation, I wondered why it was that they were able to talk about writing metacognitively. Was it their education? The reading they do for pleasure, and their other literary interests outside of engineering? Or perhaps did their experiences as women, their gender, influence their development as writers in some way?

Gender-based language difference has been long been a concern in composition studies as well as feminist theory, as scholars have debated if gender affects writing and speaking and how those differences might be characterized. Female patterns of speaking and writing have often been described through an essentializing lens as flowery, expansive, indirect, and emotional, sometimes by feminist theorists themselves (Hiatt, 1978/2003; Flynn, 1988; Annas,

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metacommunicative awareness. Metadiscursive awareness falls under what they call metacommunicative awarness. They define metacognitive awareness as "reflexive *presentations* of the cognitive status of information, such as whether it is known, new, expected (and so on) information for participants" (Culpepper & Haugh, p. 242). They argue that metacommunicative awareness "refers to reflexive *interpretations* and *evaluations* of talk, which arise as a consequence of our awareness of self and other as social beings" and metadiscursive awareness as "a persistent frame of interpretation and evaluation that has become objectified, or reified, in ongoing metapragmatic commentary about particular phenomenon" (Culpepper & Haugh, p. 242). Furthermore, metadiscursive awareness is ideological in nature, "that is to say, ways of thinking about language and language use that intersect with ways in which language is actually used" (Culpepper & Haugh, p. 242). In this study, I employ *metacognitive* to capture both the sense that the participants are aware of their own thinking as well as knowledgeable of the *metadiscursive* elements of their writing.

1985/2003).[3] On the other hand, male language use is the norm, the ideal form that is accepted

by society and by disciplines and professions. Nowhere does this distinction play out more

clearly than in science and technical writing. To describe writing for STEM, terms such as

concise, direct, unemotional are used—all terms that happen to also apply to stereotypes of

masculine writing (Hiatt, 1978/2003). Because of these cultural associations, it might seem that

writing becomes yet another barrier to the women who strive to enter STEM disciplines,

especially at higher levels such as the PhD where publishing research is vital to success. After

all, it seems that men may be naturally more capable of writing appropriate scientific discourse

because it matches their inherent language patterns.

Conversely and often in contradiction to stereotypes, women are viewed as stronger

communicators and language users, and they are simultaneously perceived as emotional and

prosy in their writing despite evidence to the contrary (Hiatt, 1978/2003; Haswell & Haswell,

1996; Haswell & Haswell, 2010). Additionally, women are frequently pushed toward the

humanities where creativity and writing are seen to be more within the female domain; Janis

Haswell and Richard Haswell (2010) point to the "pro-female bias" that affects readers'

receptions of student writing. When asked to assign a score to two different essays, readers

tended to rate the essay written by a woman—or perceived to have been written by a woman—

more highly than the one by a male writer (Haswell & Haswell, 2010). As women are often

viewed as more drawn to writing, they are also strongly associated with language-based

professions. Feminism has long been part of the field of composition (although implicitly until

the 1980s), and composition as a discipline has been a site for the inclusion of women, especially

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[3] The idea that women fundamentally use language differently is a difficult notion to get away from, or at least to discuss from the perspective that it has more to do with enculturation and social influences rather than pure biology; French feminists, for instance, are prone to discuss female style (*le écriture féminine*) in terms of the body (Ritchie, 1990/2003).

since it was women who were so often the ones teaching composition professionally (Richie & Boardman, 1999/2003; Connors, 1995). However, despite the strong associations between women and language and women and writing, men still dominate at the more prestigious levels of writing as op-ed columnists for major newspapers and award-winning novelists (Klos, 2013; VIDA, 2013; Wolitzer, 2013).

These contradictions are also present throughout the history of technical writing. Until relatively recently, women engineers and scientists were consigned to the "ghetto" of technical writing, permitted to write about engineering work but not actually perform it, especially when that work involved visiting job sites and cooperating with male contractors or construction workers (Layne, 2009). Even in technical writing, however, their contributions as writers and editors have been often invisible, overlooked or ignored, while the current high percentage of women technical writers has been noted problematically as a "feminization"—a pinking of the collar—of the field (Malone, 2010). Edward Malone (2010) examines the life and career of Lucille Pieti, who, after becoming an engineer, was "derailed from her career track, steered away from the practice of pure engineering toward technical communication" before she was eventually "stripped of her expert status and effectively silenced" (p. 147). His discussion reveals how the culture of engineering forced women into technical writing positions even if their education and talents would demonstrate their potential for exceptional engineering work, burying their contributions and muting their voices. Meanwhile, women's early contributions to the field of technical communication were overlooked and marginalized to present a picture of technical writing as masculine (Malone, 2010).

Malone's (2010) narrative of one woman engineer's diverted career from engineering into technical writing is consistent with the marginal status technical writing held within

engineering fields. He writes, "Long before World War II, technical writing and editing were niches of women's work within technical and scientific fields. The emergence of the modern field of technical communication in World War II and the postwar years continued this tradition even as male practitioners and academics sought to professionalize the field" (p. 177). This picture of the hierarchy established between scientific and engineering work and technical writing is consistent with Bernadette Longo's (2000) discussion in *Spurious Coin: A History of Science, Management, and Technical Writing*. Longo examines technical writing within historically situated institutional relationships, which allow her to argue that technical writing is part of "an economy of technical knowledge and power" (p. 8). In fact, the post-World War II world created a separation between technical writing and engineering labor, one that positioned technical writing as a "spurious coin" (Longo, 2000). She argues

> Engineers were considered to be the high-priced workers who were better used in developing the technology that would improve general living conditions and stabilize democracy. Lower-priced writers could take care of communicating these technical developments. In a trend reminiscent of the management/clerical worker separation, engineering functions were split from communication functions in hopes of greater efficiency and productivity for technological development. (Longo, 2000, p. 123).

If technical writing represents counterfeit forms of knowledge or non-engineering work, then the historical tendency to push women into performing writing tasks while blocking their access to more typical engineering labor means denying women the power to create new knowledge or to do the "real" work of engineering. While today engineers often do their own writing—and are expected to be proficient in technical knowledge and communication—this history underscores the troublesome relationship between writing and women's places within the engineering profession.

Therefore, my questions are: What does it mean to write as a woman in STEM? Do women more frequently possess the needed writing skills to succeed as STEM writers, or is writing used as another way to block access? Is it possible, however, that writing can prove a way for women to enter the STEM fields? Finally what might these connections imply for the writing education of STEM students? To frame my findings that respond to these questions, this chapter specifically focuses on the current gender bias in engineering writing despite the increasing presence of women in the field and continued attempts to promote the inclusion of women. Additionally, technical writing has become an increasing focus in engineering education thanks to the Accreditation Board of Engineering and Technology's (ABET) Outcomes, thereby asserting its importance for engineering fields and pushing against a history of hierarchization between the "real" work of engineering and writing. Yet, while composition studies has responded to writing's function within engineering practice and the demand for instruction to prepare young engineers to communicate effectively, little attention has been paid to the earned rhetorical knowledge of engineers, nor to women as writers in engineering contexts. As my research demonstrates, by ignoring the knowledge engineers possess and by failing to study women specifically, we risk marginalizing engineers as writers and marginalizing women as engineers and engineering communicators.

Women in STEM and the Demand for Communication Skills

Since the 1970s, drastic strides have been made to include more women in STEM disciplines at all levels. Women are pursuing degrees at higher rates and are more equally represented in STEM fields more than ever before, and their increasing presence is encouraging. The National Science Foundation, for instance, has awarded over $130 million in ADVANCE

funding to institutions working to increase women's participation and representation in STEM

fields. According to the NSF ADVANCE (2014) website

> the goals of the ADVANCE program are (1) to develop systemic approaches to
> increase the representation and advancement of women in academic STEM
> careers; (2) to develop innovative and sustainable ways to promote gender equity
> in the STEM academic workforce; and (3) to contribute to the development of a
> more diverse science and engineering workforce.

ADVANCE and other programs aimed at diversifying STEM have had an impact at institutions

nationwide, providing support and mentorship to students and new faculty as well as working to

transform institutionally-held policies and attitudes that create a chilly or even hostile climate for

women (Stewart, Malley & LaVaque-Mantry, 2007). As Abigail Stewart, Janet Malley &

Danielle LaVaque-Mantry (2007) demonstrate, ADVANCE-funded programs have effectively

worked to increase the presence of women in the field and create better working environments

for all STEM professionals, both men and women.

    While women's participation in engineering fields has increased drastically since the

1970s and conditions have been improving, women still have not attained equity, and in

academia, publication rates reveal that disparity. Recent research analyzing the publishing rates

of women in STEM fields demonstrates that women tend to produce fewer texts for publication,

more frequently appear as second authors, and less frequently receive first author placement

(Wilson, 2012). In the academic context, publishing is key to advancement, promotion and

tenure, and achievement in STEM, and it becomes another way to prevent full inclusion of

women in male-dominated fields. Jevin West, Jennifer Jacquet, Molly King, Shelley Correll, and

Carl Bergstrom (2013) utilize the JSTOR corpus to assess patterns of authorship, analyzing the

JSTOR network dataset, or about 1.8 million articles. Additionally, they break down the

disciplines to generate a hierarchy of prestige to assess on what subjects women are publishing

and how their publications relate overall to what is valued by specific fields (West *et al.*, 2013). They find that while the percentage of women in first author positions has increased over the last twenty years, women's authorship remains low overall, and disparity still exists in the first and last author positions (West *et al.*, 2013).[4] Additionally, even in fields such as sociology where women and men appear to publish equally, West *et al.* (2013) find that women tend to publish is less prestigious areas, indicating a hidden gender disparity. They conclude, "Though significant progress has been made toward gender equality, important differences in positions of intellectual authorship draw our attention to the subtle ways gender disparities continue to exist. The finding underscores that we cannot yet disregard gender disparity as a notable characteristic of academia" (West *et al.*, 2013, p. 6). Given the disparities West *et al.* (2013) find even in more recent publication trends, their research would seem to indicate that writing serves as yet another gatekeeper to women's success in STEM.

Indeed, the publication rates are indicative of an atmosphere that serves to exclude women in both academic and professional STEM fields. Numerous studies have demonstrated that while equity is being found in the lower levels of education with women closing the gap within many STEM undergraduate majors, equity fades as the level increases. According to Donna Dean and Anne Fleckenstein (2007), the number of women pursuing STEM degrees at the undergraduate and graduate level has increased significantly since the 1970s with women making up roughly half of undergraduate students in STEM; however, women only earn 37.5% of doctorates in the same fields. And while more women are earning PhDs in STEM fields, women are failing to earn tenure and be promoted at the same rate (Liang & Bilimoria, 2007); women are more likely to be (and remain) at the postdoctoral fellow or junior faculty level,

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[4] In collaborative publishing, especially in STEM fields, authorship is indicative of contribution. As West et al. (2013) point out, both first and last author positions are significant in indicating the level of contribution made (first author) or identifying the principal investigator or group leader (last author).

comprising only 13% of full of professors and earning 24% less than their male counterparts (Dean & Fleckenstein, 2007). Dubbed "the leaky pipeline," the failure to retain women within academia and higher professional levels is indicative of ongoing gender disparity and an environment that is often hostile to women and inhibits their success. As Dean and Fleckstein (2007) argue, "One must consider that women are diverted from the pipeline at higher rates and earlier stages than men, and that the pipeline is porous in a selective way that forces out more women than men" (p. 30). The environment women face when pursuing careers in STEM is one that inhibits their ability to be successful, even if they are more than capable.

In fact, recent findings by Corinne Moss-Racusin, John Dovidio, Victoria Brescoll, Mark Graham, and Jo Handelsman (2012) demonstrates that both male and female science faculty show bias for male students and against female students, albeit subtly rather than overtly. To determine this bias in their double blind study, Moss-Racusin *et al*. (2012) sent applications for a lab manager position from identical male and female candidates to faculty at research-intensive universities. They found that the male candidate was rated more highly and offered a better salary than his equally qualified female counterpart, and that the gender of the faculty participant did not have an impact on the rating each candidate received, indicating a subtle bias against women by both male and female faculty (Moss-Racusin *et al*., 2012). Additionally, their findings demonstrate that faculty of both genders showed less motivation to mentor women (Moss-Racusin *et al.*, 2012). This subtle bias serves to create an atmosphere where women feel less than welcome, and where they may be discouraged from pursing further study in STEM fields. As Moss-Racusin *et al*. (2012) conclude, "Our results raise the possibility that not only do such women encounter biased judgments of their competence and hireability, but also receive less faculty encouragement and financial rewards than identical male counterparts" (p. 16478). It is

that lack of encouragement and mentoring that can influence women's persistence in the field (Burke, 2007; Dean & Fleckenstein, 2007; Liang and Bilimoria, 2007). Additionally, women are rarely shown equally in science materials, the concerns of science are often presented as male concerns, and women are generally given less access to the materials conducive to doing science, clearly indicating that men are the norm in science whereas women are the deviation (Burke, 2007). The message that tells these women, overtly and subtly, that *you don't belong here* is one that must be overcome before equity can be fully attained.

In the face of this pressing need to work to eliminate gender bias in STEM to enable women to more easily succeed, STEM disciplines have also actively sought to improve the quality of writers graduating from undergraduate and graduate programs. The Accreditation Board for Engineering and Technology (ABET), which accredits engineering programs nationally and worldwide that meet their criteria for a standard engineering curriculum, requires engineering programs to demonstrate that their students are prepared for professional environments (Felder & Brent, 2003; Williams, 2001). One of these major demands is that students be able to communicate appropriately and display both creativity and critical thinking when confronted with problems in the workplace, skills that employers have long complained students lack (Plumb & Scott, 2002; Williams, 2001). As Julia Williams (2001) indicates, although ABET does not specify course requirements to develop these particular skills, they do demand evidence that students are given ample opportunities to acquire them, thus emphasizing writing within and outside of engineering courses and contexts. The ABET Outcomes require engineering programs to ensure that their curriculum adequately prepares their students to communicate effectively in the workplace; therefore, if there is a connection between gendered

experiences and writing ability, then it could have important implications for meeting the ABET Outcomes with regard to communication.

The tension that exists between the ways gender disparity is exhibited in engineering writing and the increasing attention given to engineering communication in undergraduate programs provides a space for a composition researcher to examine women's writing in engineering and its role in professional success. However, the tendency in composition studies is to talk about engineers and the writing they do as though we, the composition scholars, have all of the knowledge, and to neglect women as participants. For instance, in her otherwise informative and in-depth study of four engineering students, *Writing Like an Engineer*, Dorothy Winsor (1996) seems to operate on the assumption that her subjects are generally unaware of the rhetorical elements of writing, even implying that engineers do not find the writing they do to be pleasurable or particularly well-written, though it may be effective. My research, however, demonstrates that this is not the case, and it is an assumption that may lead to a problematic interpretation of data. My conversations with Katy, Christine, and Emma indicate, in fact, that these writers take pride in being strong communicators and are much more aware of concepts such as tone, style, and persuasion than Winsor accounts for. The problem thus is that if researchers begin investigating engineering writing with the assumption that only compositionists themselves possess knowledge, awareness, and theories about writing, what are we missing? It seems that Winsor (1996) is unaware of how the power dynamic between her (an English professor and researcher) and her subjects (engineering students) affects the ways her participants respond to the rhetorical situation within which they are positioned and the inherent hierarchy between researcher and subject, not to mention the historical institutional tensions between engineering and writing departments. Furthermore, my study explores this problem

within the context of gender—does the experience of women as gendered subjects enable them to speak of writing more metacognitively than Winsor's subjects?—as well as how our assumptions as composition researchers may prevent us from seeing these participants, male and female, as individuals who claim the identity of both engineers and writers.

Besides the tendency to overlook or downplay the earned rhetorical knowledge of engineers, researchers generally focus on only male participants. Little has been written by composition scholars about engineering writing that examines women specifically, and some studies exclude women altogether. For instance, Winsor (1996) focuses on four male engineering students; however, she notes that 20% of the students at the participants' academic institution are women. Winsor (1996) does not address the failure to include women in her study, nor does she indicate that her findings might have benefitted from the inclusion of women. While it may simply be that few women were available for participation (it was, after all, a 5-year longitudinal study), by not considering the implications of using only male participants, Winsor risks confirming the status quo that men, and men's writing, are the norm, while women are the outliers who lurk on the fringes of engineering schools and professional institutions. Similarly, Winsor (2003) does not address the scarcity of women in her study *Writing Power: Communication in an Engineering Center*. Again, her research focus in this more recent study is the interaction between written genres, knowledge, and power in an engineering context and not gender, though an analysis that examines power and writing is certainly ripe for the inclusion of a focus on gender. Yet most of her subjects are male, which remains unaddressed likely because men are the norm in this context: from the technicians to the engineers to the managers, men dominate Winsor's (2003) study. Jon Leydens (2008) briefly addresses the lack of women in his study "Novice and Insider Perspectives on Academic and Workplace Writing: Toward a

Continuum of Rhetorical Awareness" by noting that no women were enrolled or available to participate. The problem of finding female participants is one that researchers examining engineering discourse will encounter, though where possible, women should be included. By focusing primarily on women, my research addresses this problem and offers a contribution to the composition studies that creates a space for women. If we continue to fail to include—or focus on—women in our research on engineers and their writing practices, we risk perpetrating the message that women do not have a place in engineering as professionals and writers.

Methodology

To approach these concerns, I developed a methodology that would use multiple forms of data to provide a clearer sense of how women write in engineering, how their experiences play a role in their self-identification as authors, and the ways their gender might affect their production of text. Using an ethnographically informed case study approach, I selected three participants with whom I could work in depth, focusing on Katy as a central case study and incorporating findings from the other two cases—Christine and Emma—to draw distinctions and find commonalities that are reflected in engineering environments. In order to examine my research questions from several perspectives, my methodology draws from both ethnographic and case-study approaches (Lauer & Asher, 1988; Merriam, 1998), as well as being informed by feminist composition research. While my study is not precisely an ethnography (or an ethnography of communication), it does lie on what Green and Bloome (1997) describe as a spectrum that encompasses the variety of ethnographic approaches (as cited in Sheridan, 2007). As Mary Sheridan (2007) points out in "Making Ethnography Our Own: Why and How Writing Studies Must Redefine Core Research Practices," even when composition researchers are not engaged in what might be defined by anthropology as "true ethnographies," "they adopt ethnographic

perspectives or use ethnographic tools" (p. 81). Sheridan (2007) thus argues that we should "feel

confident to adapt these methods so they are appropriate to our forum, uses, and practices," (p.

82), which characterizes my approach throughout this dissertation.

My strategies for approaching this dissertation are informed by composition research

methodologies that also incorporate feminist theory. For instance, Patricia Sullivan (1992/2003)

calls attention to the value of bringing in feminist approaches to composition research to delve

into the interactions between literacy, academic discourse, gender, and culture, complicating

notions of academic writing as objective or value-free. She comments:

> Feminist scholarship in composition thus has both reactive and proactive components: it
> focuses on received knowledge—on the existing studies, canons, discourses, theories,
> assumptions, and practices of our discipline—and reexamines them in the light of
> feminist theory to uncover male bias and androcentrism; and it recuperates and
> constitutes distinctively feminine modes of thinking and expression by taking gender, and
> in particular women's experiences, perceptions, and meanings, as the starting point of
> inquiry or as the key datum for analysis. (Sullivan, 1992/2003, p. 126).

While Sullivan (1992/2003) clearly delineates the possibilities for feminist approaches to

composition, in some ways she falls back on what could be seen as essentialist understandings of

gender by arguing that there are distinctly feminine ways of thinking and writing that are

suppressed by masculine discourse, though admittedly she is interested in the influences of

culture and socialization on these modes which does operate to silence female voices. Because

feminists are engaged in the project of cultural critique, they must demarcate what is masculine

and what is feminine to examine how women's voices are being suppressed or subjugated, even

when it runs the risk of essentializing. My findings indicate that while there is little variation due

to gender in the products of writing—the subjects were learning or had learned what it meant to

be an effective engineering writer—their experiences as women, as well as readers' expectations

of their texts because of their gender, certainly affect how they wrote and how they identified as

writers. In other words, I might push against the idea that men and women write in drastically different ways or use language differently (at least in the context of engineering communication), yet gender does still influence the writing these women produced and continue to create.

One advantage to approaching this study from a feminist perspective is that feminist researchers are often conscious of the problems with concepts such as objectivity and clarity, often attributed to masculine, "scientific" writing, that block other researchers from using potentially useful tools. Debra Journet (2012) explores the use of narrative, often a tool for feminist researchers, arguing that narrative should be read as conventional forms of discourse that are not inherently less objective or unscientific than other methods. Similarly, Liz Rohan (2012) cites feminist methodologies when discussing historical research, indicating that researchers must ethically represent their subjects (living or deceased) even while being affected personally by them. Rohan (2012) points out that researcher presence is not always negative and can in fact expose research gaps. She comments, "Recent scholarship among feminist scholars in composition, however, indeed demonstrates that self-reflective practices often inspire scholars to question or abandon the rhetorical voice of detached objectivity when recovering and representing their research" (p. 34). Cynthia Selfe and Gail E. Hawisher (2012) also bring a feminist approach to their discussion of research approaches, asserting the need to learn from and use the relationships they form with their subjects "to construct a participatory model of research that challenges more conventional understandings of investigations and the power relations between the researcher and researched subjects" (p. 37). This desire to learn from participants and complicate traditional hierarchies between researcher and subject is also present in Christina Hass, Pamela Takayoshi and Brandon Carr's (2012) research on digital literacies. And because feminist approaches often make their way into digital literacy, Kristine Blair (2012) comments

that "feminists must learn to deploy an activist politics that can address issues of identity, representation, and empowerment in a digital age" (p. 65). While these latter sources focus on digital literacies (which is outside the focus of this research), their use of feminist approaches indicates the current trend in feminist composition research. This dissertation—from methodology to results—represents a desire to break down the simple researcher/subject hierarchy and the attendant power dynamic, inviting the participants to be co-researchers with me. In other words, I acknowledge and value what it is they already know about writing as well as their extensive expertise as engineers, rather than positioning myself as the composition expert. My dissertation thus speaks to Blair's (2012) call for activism in composition research.

The Participants

Three participants were recruited from a variety of engineering backgrounds. The first participant, Katy, is a professional civil engineer who works for a mid-sized consulting firm that specializes in wastewater and environmental projects. Katy and I met in 2005 when I worked for the civil engineering department. Her tendency to initiate conversations with me about writing, in fact, was a major impetus for this study. Katy holds both a Bachelor of Science and Master of Science in Civil Engineering from the same academic institution. She was recognized as the top graduate by the College of Engineering when she graduated with her bachelor's degree, which was a major reason her current employer recruited her and kept her on part-time as she pursued her master's. She has earned her professional engineer (PE) licensure and is also LEED certified. While in college, she was active in a number of student and professional organizations; however, she said that her high level of involvement led her to feel burned out, so is she currently less active as a professional. Her professional involvement includes membership in the American Society of Civil Engineers (ASCE), the American Water Works Association (AWWA), the

Water Environment Federation (WEF), and several state organizations. She actively presents at state conferences, and she also serves as the practitioner adviser for the student-chapter of ASCE at her alma mater, where she says she is the first practitioner adviser to attempt to participate beyond signing reports. She has been employed at the same firm that hired her when she graduated for the past ten years. When I asked why she chose to become an engineer, she gave an unexpected response that conveys a lot about who she is:

> True story, I read too much Ayn Rand. Yeah, that was pretty much it. I think I came in and I was just interested in a lot of things. In my first semester, I was actually undecided, and I just took things that I thought were interesting to me […] I kind of felt unfulfilled and unchallenged by a lot of it, and I couldn't see myself making a career out of some of the things I was involved in, and so I knew I was going to have to sign up for the spring classes, and I kind of had a huge anxiety attack, like oh my god, what am I going to do? I can't stay undecided forever, I've got to make a career choice now, now, now, now! So I literally went through the course catalog and read a whole bunch of course descriptions and decided which ones I thought were most interesting and which ones I wanted to pursue, and I don't think I gave a lot of thought to, oh I want to be an engineer necessarily as much as I thought that these courses sounded interesting and challenging, and I think this is what I want to do, so I enrolled for a bunch of them. Really, the first semester was not all that great either, but I stuck with it, and I just kept going. […] I read a lot of Ayn Rand, I really did, I read *Atlas Shrugged* and thought it was the best thing since sliced bread, which is kind of hysterical to me now. There are parts of it that still resonate a little with me, but to a ridiculous degree not so much. But yeah, it just seemed like engineering was this very purposeful thing where you have this amazing creation at the end of it that's supposed to have a great purpose for society one way or another and you have a hand in doing that. But […] that's a really noble view of it—there's a lot of b.s. that goes into the front end of it to actually make it happen that's very painful—so it's not all roses and champagne. (7 Nov. 2013)

Her motivations for pursuing engineering were perhaps atypical, but they do reflect her desire to do something that was both challenging intellectually and contributed to a better society

The second participant is Christine, an academic industrial engineer. Christine and I did not officially meet until our first interview, and I had asked a mutual friend (another academic engineer) to broker an introduction after several failed attempts to reach out to academic

engineers I did not know. She earned all three of her degrees—bachelor's, master's and PhD, from the same institution and came to her current job as an assistant professor. She is now a full professor who researches transportation and logistics, specifically maritime transportation. In addition to her activities as a researcher and teacher, Christine heads up a research center and was recently appointed as an associate dean within the College of Engineering. She is also actively involved in various professional organizations, such as the Institute of Industrial Engineers, the American Society of Engineering Education, and the American Association for Engineering Management, within all of which she has held leadership positions. She has also served on several editorial boards for various journals and is active in organizing conference tracks and chairing sessions. She was previously the faculty adviser for the student-chapter of the Society of Women Engineers and is currently their counselor, a much less active role. Overall, her professional involvement is high and always has been high even while in graduate school. I did not ask Christine why she decided to pursue a career as an industrial engineer, though her comments about her work indicate that it is a satisfying field for her to be in, and she enjoys the contributions she is able to make through her research.

The final participant is Emma, a sophomore-level biological engineering student who is also a first-generation college student. I met Emma when I gave a writing presentation to a student organization. During that presentation, I was struck by her insightful comments about writing, so I emailed her to invite her to participate. In addition to majoring in biological engineering, she is also pursuing minors in sustainability and African/African American studies. Her career goals include potentially pursuing a doctorate through the Peace Corps to be an educator as well as an advocate for sustainable action and sustainable building. She has served as a research assistant for the biological engineering department and an intern with the Office of

Sustainability, and her organizational involvement is primarily with Arkansas Engineers Abroad. She was selected to participate in a study abroad experience in Tanzania focusing on wildlife conservation and political ecology for which she earned a scholarship. Her goal in pursuing a career in engineering is also focused on the social good; she told me, "I want to help in building sustainable communities" (25 Aug. 2014).

Data Collection

With feminist approaches in mind, especially the role of narrative to reveal useful sources of data, I developed my data collection techniques to gather several forms of information, including interviews, direct observation, and writing samples. The study proceeded in three parts: an initial interview, a series of observations on the production of texts, and a final set of interviews, one that focused on eliciting the author's comments on select pieces of writing and the second that allowed me to ask more pointed questions about gender. The initial interview served as a base to build from in subsequent interactions with the participant, creating camaraderie and asking the participant to contribute their knowledge. These interviews often got off track as we discussed writing and experience, as each of these women were confident writers and were interested in ideas about composition, and as they shared experiences that shaped them as engineers and writers. This intake interview was approximately an hour-long conversation with each participant, though my conversation with Christine was cut a little short when she had to leave for another meeting. Additionally, for Katy, I conducted interviews with four individuals at her firm, two of her superiors and two peers. These interviews allowed me to get a richer sense of the context in which Katy works and compare attitudes toward writing within the same firm.

The second form of data collection involved writing observations: I asked the writer to compose while I watched, took notes, and asked questions. I was able to observe multiple

sessions with Katy as she crafted a variety of documents in several genres such as meeting

minutes, a preliminary engineering report, and an operations and maintenance (O&M) manual,

as well as equipment submittals that she had to comment on and return to manufacturers. I was

able to schedule one session with Emma as she wrote up the quarterly reflection she had to

submit to the Clinton Global Initiative as a requirement for a grant. Because of her limited

availability and the nature of her current writing projects, I was unable to observe Christine while

she worked on her writing, though she provided a good sense of her process in a final interview.

While initially awkward, these observations sessions provided useful real-time information about

Katy and Emma's composing processes and what they were thinking as they wrote, and they

usually relaxed once I started asking questions. During these sessions I could see their thinking

as they worked through how to state an idea appropriately or explain a problem for their intended

audiences. These observations also allowed me to ask them questions about engineering content,

positioning the participant as the expert and me as a learner, an inversion of the traditional

researcher-participant hierarchy important to feminist research methodologies. I needed the

participants to teach me about the engineering genres they were writing within, and I valued the

knowledge about engineering practices and approaches these observation sessions provided. I

also elicited their expertise as I gathered writing samples, since the participants had the ability to

control what writing samples they provided to me for analysis, and I gathered more information

from them when I interviewed them about their samples to enrich my analysis and discussion of

their writing.

　　　　After conducting the writing observations, I asked for various writing samples to use to

conduct the first of the final set of interviews, the postobservational interviews. These interviews

focused on learning more about the writing I observed. Additionally, because I was unable to

observe Emma doing specifically engineering writing because it was a group report completed at the last minute, nor was I able to observe Christine, I used this final interview to learn more about the writing sample as well as each writer's process and feelings toward that writing. In the cases where the writing was paired with interviews, I was able to learn more about the document as a finished product rather than a work in progress. In the case of Christine, I used this interview to learn more about the ways she interacts with her graduate students and how that collaboration affects the writing activity she does.

Finally, because I wanted to avoid calling the participants' attention too much to their gender, I used the final interview to elicit information about their experiences as women in engineering. While all participants understood that I was examining women's writing in engineering, I attempted, as much as possible, to avoid making gender the central concern of our early interactions. In other words, I wanted to observe them and discuss their writing without introducing gender considerations into the picture, at least as much as possible. It was the final interview that allowed me to get a sense of how each participant experienced engineering in connection to her gender as well as to understand how she believed her gender and her experiences as a woman affected her as an engineer and as a writer. These multiple forms of data and methods enabled a triangulation of data that can permit a confirmation of findings as well as reduce the effect of several problems, such as over-willing participants and confirmation bias, while enacting a feminist methodology that invites the participants to work with me as a co-researcher rather than simply a subject.

I took notes during each interview or observation session, and I created a document to transcribe the recordings that contained three columns: time, transcript, and notes. Given the time-consuming nature of transcription, I focused on paraphrasing some parts of the interviews

and fully transcribing participant responses that I believed would be most relevant. In the transcription, I also edited the responses to remove verbal interferences that would impede the ability to easily read. Throughout, I use an em dash (--) to indicate a significant pause during a response, and bracketed ellipses ([…]) to indicate where I removed some material to improve readability. As much as possible, I sought to appropriately characterize each woman's way of speaking while also maintaining readability. Finally, I conducted member checks to allow each woman to comment on my representation of her to ensure that I was not misusing her words or misrepresenting her experience.

Limitations

A primary methodological concern that has emerged is that Katy, the central case study, and I knew each other as friends before I worked with her as a participant. Despite the potential methodological issues and possibility of bias, I was drawn to her as a case study because I knew her to be an intelligent, deeply committed professional, and someone who actively thinks and talks about writing. In fact, it was our conversations about her engineering work and the texts she creates that sparked my interest in studying engineering communication. While our friendship might have impeded my ability to be a completely disinterested researcher (if such a thing is possible), my goal was not to strive for total objectivity as one might in laboratory research but instead to explore and accurately represent Katy's experiences as an engineer and woman and writer. In this case, my friendship with her outside of the study actually enabled her to be more honest and open with me, especially when it came to discussing her gendered experiences and how her gender affected her professional life, and for me to more fully understand her and the conclusions the data points to.

Indeed, ethnographers have long wrestled with what it means to be objective as participant-observers. For instance, Clifford Geertz (1973) notably examined the problem in using scientific approaches to understand culture. Arguing instead that culture should be viewed as semiotic, he comments: "Believing, with Max Weber, that man is an animal suspended in webs of significance he himself has spun, I take culture to be those webs, and the analysis of it to be therefore not an experimental science in search of law but an interpretive one in search of meaning" (p. 5). Feminist researchers especially have fought to balance accurate and ethical representation against the consciousness of biases, perspectives, and experiences that influence that representation (Sullivan, 1992/2003). For example, Liz Rohan (2012) explores the challenges archive researchers face with regard to objectivity and representation, commenting that "Recent scholarly projects therefore demonstrate that a scholar's bias, empathy, or felt connection with a deceased other need not be edited from a research agenda or even a research report" (p. 30). While my own research is not archival, Rohan's (2012) discussion suggests that attempting to edit out the researcher's perspective may in fact lead loss of insight or significance.

Several approaches helped me counteract the potentials for bias and enable me to achieve findings that are significant as well as insightful by triangulating the data I collect. First, while the bulk of my observation and research focused on Katy, Katy's writing, and her workplace, the other case studies enabled me to confirm the findings as either particular to Katy's case or as having broader implications. Additionally, I used a number of research methods to elicit different kinds of data, including interviews with those who work with Katy as well as the data collection techniques detailed above. Because I know Katy outside the context of her professional work, I selected my other two participants carefully, choosing two individuals with whom I was unfamiliar outside of the university setting and had little to no interaction with before I began

collecting data. Both Christine and Emma expressed concern about how "useful" they would be for this study, but the commonalities between all three participants despite their differences in writing production reveal the value in exploring what might be viewed as trivial or inconsequential by engineering writers, but may also be central to their professional practice.

For this dissertation, I have chosen to focus only on engineering women rather than participants from other fields in STEM, though the participants come from three different engineering subdisciplines: civil engineering (Katy), industrial engineering (Christine), and biological engineering (Emma) and currently work at three different levels as a professional engineer (Katy), an academic engineer (Christine), and an engineering student (Emma). While I also offer conclusions that are relevant to STEM fields more broadly, I do so with caution and with regard to engineering education specifically. As Margaret Layne (2009) points out in her introduction to *Women in Engineering: Professional Life*, "engineers are not scientists" (p. ix) and that important distinctions must be maintained about the work each does and education level obtained. However, by including participants who are academic engineers, some parallels can still be drawn, and it is hard to ignore that women scientists and engineers often face the same realities when it comes to gender bias and academic and professional experiences. And while I focus on engineers and my conclusions most appropriately address engineering writing and education, I point out ways the findings pertain to broader issues within STEM, opening space for further research.

As the status of women in the STEM disciplines continues to be a major concern, composition scholars will continue consider how writing serves to enable or hinder women's advancement. We also benefit by examining what qualities women may bring with them when approaching writing, extending feminist and gendered approaches to writing. As current

composition scholarship generally neglects to account for how gender may affect STEM writers and writing, this dissertation introduces and explores the ways women's experiences and education affect the writing they do, and the professional implications of their writing. If we consider STEM writers as metacognitive about the writing they do and as possessing a writer's identity, we can then move toward a methodology that asks these writers to be partners with us in our work, not passive objects for our examination, and we can value their knowledge. This research strives to write women into engineering practices as both professionals and writers, recognizing their contribution to engineering knowledge and their presence within engineering, in an attempt to present to a more equitable representation of women as well as contribute to efforts to increase the number of women pursuing STEM careers.

Chapter 2

Engineering a Writer Identity

During my first day of observation, Katy gave me a tour of her office, including

introducing me to her coworkers. When she explained that I was "an English person" and

conducting research on engineering writing, the reaction from her fellow engineers was generally

immediate anxiety (*oh, I better watch how I talk around you!*) and incredulity (*why would you

want to study something as boring as engineering writing?*). Katy's colleagues clearly viewed

writing as something engineers were not skilled at, something that they did not wish to be judged

on, and something that they had no desire to share with anyone outside the engineering world.

And they saw me either as the person who would be judging their language use or as an

incomprehensible oddity because I expressed interest in studying engineering writing. The few

engineers who seemed unfazed by my presence were both younger: one enjoyed reading and

writing generally and so was curious about my project, the other held an undergraduate degree in

English and was a confident writer.

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In her study of student engineers *Writing Like an Engineer*, Dorothy Winsor (1996)

observes a problem with the idea that engineers are poor writers: if one wants to be an engineer,

then perhaps one should not be skilled at communication—writing does not have a place within

an engineering identity. In fact, the belief that being a writer is antithetical to a professional

engineering identity could limit the ability of novice engineers to learn to communicate

appropriately in professional contexts, since "If engineers don't write well and one wants to be

an engineer, then perhaps one doesn't have to learn to write too well either. As a matter of fact,

maybe one shouldn't because to do so would be to mark oneself as not an engineer" (Winsor,

1996, p. 88). Furthermore, studies have demonstrated that attitudes toward writing may shape performance, meaning that those who are less confident of their ability may be unable to write effectively (Charney, Newman & Palmquist, 1995). A logical extension is, then, if writing is not seen to be part of engineering, or if poor writing ability is considered an aspect of the culture, then these attitudes perpetrate the stereotype and lead to less-confident productions of text on the part of engineers. One aspect to consider when analyzing the studies that examine engineers' attitudes toward writing, however, is the way that engineers draw distinctions between their technical writing and what they see as more highly valued literary or creative writing. Since literature is written with the intention to be artistic, these writers believe that their technical texts are simply not as good by comparison or perhaps that aesthetic quality is not a component of effective technical prose, even if those same writers take pride in that work or consider it central to their engineering practice.

This chapter takes up the issues of writing's place within the culture of engineering and challenges the notion that craft—in the form of careful stylistic considerations and other features that are meant to engage a reader—has no place within professional discourse. In one way or another, again and again, Katy, Christine, and Emma all demonstrated implicitly or explicitly that they possessed a writer identity and highly valued their ability to write effectively. These findings run counter to typical attitudes about engineers and about engineering writing. Examining the earned rhetorical knowledge of these participants as well as the experiences that led to the development of a professional identity that includes writing will uncover some of the somewhat invisible and potentially unacknowledged power of writing in engineering contexts. This writing takes place in what Winsor (2003) refers to as text-mediated contexts, where the "documentation about [the object] can serve as a more reliable form of the object than the object

itself" (p. 63), though that writing is not necessarily equated to the object and therefore may not hold the same status. Given the degree to which the work these women produce is mediated through texts that would be accepted if they were simply passable rather than outstanding, why do they take such care with their writing? How does their attention to the craft of composing to engage their reader link to their developed or developing professional identity? These writers, with little or no formal training in technical communication, are able to understand the demands of the rhetorical context and to shift their style in order to appeal to a specific audience or audiences. In addition to exhibiting their abilities, these women also generally identify as writers, though not always in the ways that someone outside engineering (or STEM) might recognize. This acknowledgement is not always considered in line with an engineering identity though these women manage to reconcile these two versions of their professional lives in an attempt to display their abilities and enhance their professional reputation.

Literacy Experiences and a Writer Identity

One set of experiences all three participants share is writing and working with written text both throughout their formal schooling and outside of school or professional contexts. Katy, Christine, and Emma each discussed their personal and educational experiences as readers and writers, expressing the ways they enjoy both the consumption and production of text. This section examines each woman's personal history with writing as a way of examining the intersections between her professional identity and writer identity. For some engineers and engineering students, writing may be understood as separate from engineering or viewed as a tool to facilitate the "real" work of engineering, yet as the participants demonstrated, authorial identity need not be separate from their professional or engineering identities. In fact, it may be these women's awareness of themselves as writers and their attention to the texts they produce

that enabled them to acquire technical genres and communicate more effectively. In other words, because they do embrace "writer" as part of their identity, they may be more conscious of the text-mediated, often less-visible nature of engineering work, and thus pay more attention to the writing that is central to the forms of making they do as professionals.

Katy

Katy was unique among her colleagues in her firm in that she strongly identified as a writer and spoke with pride in her writing ability, rather than hiding behind the attitude that engineers do not also need to be writers. While her coworkers responded to the question with surprise or dismissal, occasionally reevaluating the role writing plays in their professional identity, Katy's responses indicate that *writer* is something she identifies as both personally and professionally. Her experiences in high school and college enabled her to write not only for her college courses, but also as a slam poet and later in other avenues, including a personal blog and an essay contest sponsored by the American Society of Civil Engineers. Her identity as a writer empowered her to tackle the unfamiliar genres she encountered when she began working for her engineering firm and to assume a level of authority as she gained expertise; in fact, she continues to explore new genres of writing such as blogs and other projects in relation to her personal and professional writing experiences.

Through our conversations and in her writing, Katy demonstrated the ways that her identity as an engineer was linked to her identity as a technical writer. When asked how she felt about her writing, she commented "I feel like I'm a good technical writer," although she later added, "I don't really necessarily enjoy technical writing. Like when I do it, it's a little painful, where it's me and myself and my brain and a bunch of technical things, and technical manuals, reference manuals and stuff to give me ideas to reference back to…just buckling down and

writing this report. And it's not very exciting" (7 Nov. 2013). Yet she also expressed her deep satisfaction for a job well done. While the process might be painful, boring, and not always enjoyable, the finished product was a source of professional pride: "I always feel really good about the end product, like as much as I bitch about having to do it, I'm really, really proud of it at the end, where I'm like 'this is a fine report'" (7 Nov. 2013). She stressed that she understood the importance of writing well within engineering and how writing was tied to her professional identity.

Christine

During the intake interview, Christine indicated that she too identified as a writer, though she was careful to distinguish it from more creative literary genres. In other words, she did not feel like a *creative writer*, but she knew herself to be a strong engineering writer. Her curriculum vitae listed publication after publication, as well as awards for effective writing. In the intake interview, Christine pointed to those awards as evidence of her capacity for writing and as one of the many factors that distinguished her from her peers. When I asked how she felt about writing, Christine avoided offering a clear answer despite having previously indicated a confidence in herself as not only a competent writer but as someone recognized for her writing ability. Instead, she focused on her struggle to carve out sufficient time to write, though she added, "I feel pretty comfortable from a skills standpoint, at least for doing the writing that I need to do," justifying it with the observation that writing is something for which she is rarely criticized and often receives praise (23 June 2014). However, when I asked her if she liked writing, her response was much less equivocal: "I do. I do like writing. I like research-related writing, and I like writing I feel is beneficial, you know like value-adding writing, if I feel like I'm writing something that will then help people to do, to submit a proposal or something" (23 June 2014). She remarked

several times that she was "an avid reader" and loved to "devour books" (23 June 2014); reading was one of her primary hobbies. Even if she viewed her reading as not particularly intellectual, she valued it for herself and consciously drew a connection between her life-long identity as a reader and her ability to write well. As I examine throughout this chapter, these understandings of genre difference and links between reading and writing selves are essential to the formation of a professional writing identity.

Emma

Unlike Katy and Christine, Emma is still forming her engineering identity, but as a biological engineering student, she has come to see herself as a writer and understand the power of effective communication to accomplish engineering goals. Interestingly, she initially described herself as a *creative technical writer*: "I feel like I'm a very creative technical writer. I'm not extremely creative where I get down and write fiction stories and things like that, but I take it from, I use metaphors in a lot of my technical papers, and I try to engage the audience as much as possible" (25 Aug. 2014). As I will discuss below and in the final chapter, however, this sense of herself as creative changed over the course of the semester we worked together. With her extracurricular commitments and demanding engineering education, Emma is a busy student, yet she is also pursuing minors in sustainability and African/African American Studies, and she is actively involved in an engineering community project funded through the Clinton Global Initiative (CGI). When I met her to conduct the intake interview, I observed her reading a book not for class but because she wanted to know more about a particular culture and place. Her various activities and educational experiences are one factor that may contribute to how she characterizes herself as a writer in engineering.

Like both Katy and Christine, Emma is an avid reader who drew connections between her reading and the writing she produced; however, as she began internalizing the discourse characteristic of technical genres, she felt some unease with what she perceived as a loss of creativity or a creative self. So while she was proud of her emerging engineering identity and saw herself as a potentially skilled engineering communicator, she wondered if that identity was undermining the more creative one that she had developed during high school. This conflict in her writing identity also led to her questioning her writing abilities, waffling back and forth between claiming that she was a good writer on the one hand—especially considering what she's accomplished with her writing—and then asserting that she could "definitely improve," commenting "I'm 60% confident with my writing[…]I feel like if I had just one more class underneath my belt, just to confirm that I'm a good writer, then I would get the 40% confidence" (25 Aug. 2014). Her confidence seemed to improve, however, as the semester continued, though her feelings toward her writing may be related to her developing engineering identity. In a way, her case represents attempts to reconcile those seemingly conflicting identities or to accept how the technical report genre had begun reshaping her writing as well as her sense of herself.

Genre Awareness and Professional Identity

The role of genre in the formation of professional identity is one that has been explored by both scholars interested in the socialization of novices into professional settings as well as those examining the role of genre in social structures. For instance, Winsor (1996) traces the progress of her four student participants over five years as they acquire both engineering knowledge and learn to write within engineering, connecting that education to their professional identity. Jon Leydens (2008) argues that identity is crucial to how engineering communicators relate to their written texts and to the role of rhetoric in their writing: "rhetoric matters, effective

writers guide readers to particular knowledge conclusions via the skillful marshalling of data, and readers interpret data judiciously. Thus writers enact identities as confident change agents" (p. 254). His study explores rhetorical knowledge in terms of a continuum, noting that the participants with more educational experience in writing as well as professional experience were able to more clearly perceive their function as an agent through the writing produced. As one participant noted, "ideally writer selves and engineering selves are integrated and not separate" (Leydens, 2008, p. 254).

In addition to the role of genre in professional identity formation, Winsor (2003) explores the function of written genres in the hierarchization of a for-profit engineering setting. She analyzes the genres within the social context to learn the ways certain forms of writing are privileged over others for the action they are able to accomplish and the perceptions by various readers. In some cases, depending on who produces it and how it is viewed by the organization, a form of writing may not be recognized as a genre (Winsor, 2003). In her study, Winsor (2003) argues that technician's texts, for instance, are rendered invisible because of the hierarchy in place. She notes that "Genre theory tells us more than a matter of knowing how to read and generate grammatical prose. A successful writer must also be able to 'read' the typified social situations that indicate which kinds of text are appropriate" (Winsor, 2003, p. 120). Thus for these writers, understanding their role within their organization as part of their professional identity is crucial to their production of texts, as well as their ability to assume forms of power in those settings.

Meeting Minutes—Katy

For Katy, several genres function to enable her to craft her professional identity as well as assert her ideal image of engineering practice. In our conversations she brought up *efficiency*

several times to refer to various ideas, including efficient use of her (and the company's) time and resources and effective and efficient language. Her emphasis on efficiency was most directly targeted at the monthly meeting minutes she was responsible for creating and disseminating for the major wastewater treatment plant project she had designed and had been in active construction for several years. The meeting minutes would prove to be a contentious document, sparking several conflicts within the company (explored more specifically in Chapter 4); however, my goal in this chapter is to examine the meeting minutes as a rhetorical genre that enables Katy to take specific kinds of actions and present a clear professional identity.

Carolyn Miller (1984) defines genre not by how it looks but by what it does—it is the way members of a community respond to a rhetorical situation that they encounter repeatedly, with an emphasis on the *social action* that a writer uses the genre to accomplish. In other words, as scholars following Miller have demonstrated, genres are part of a larger social context and they provide users with established ways of responding to situations they repeatedly encounter. Anis Bawarshi (2003) goes so far as to remark that genres are the place where writing begins; his argument is that invention originates within genre rather than within the individual writer themselves. Furthermore, Amy Devitt (2000) remarks on the effects genres have on everyone connected to a text, emphasizing genre's changing and dynamic nature: "The text, the writer, the context, and the critic, too, as a reader, are shaped by genre. That is the fuller power of genre" (p. 703). While Devitt (2000) notes that genres—even literary ones—are inherently instable because of their connection to social and historical contexts, genre analysis focuses on what Catherine Schryer (1994) refers to as "stabilized-for-now or stabilized-enough sites of social and ideological action" (p. 108). Because genres are dynamic or unstable, they are able to be used by writers to respond to changing situations or community needs or even undermine power

structures in place. Genre theory enables us to not only analyze the text within a given genre or groupings of related genres called a genre systems (Bazerman, 1994), sets (Devitt, 2008), or ecologies (Spinuzzi, 2004), but also to account for the contexts surrounding the creation and reception of a particular text.

Genre analysis thus enables a reading of a particular text in terms of its relation to similar texts, as well as the motivations of the writers, which, in this case, is the ways that writers use texts to achieve their specific goals in a given context. As I will demonstrate in this section, Katy is able to use her earned rhetorical knowledge to both understand why a particular genre—the meeting minutes—was failing as well as to manipulate that genre to assert her own authority and professional identity. Katy repeatedly demonstrated her rhetorical awareness of the actions the minutes were meant to accomplish: the minutes were, variously, a documentation of the meeting itself, a reminder to the contractors and other participants about what needed to be accomplished before the next meeting, a legal document, and a method of communicating with everyone involved in the project. Her dissatisfaction with how the meeting minutes were constructed and her awareness that they were essentially being ignored, thus wasting everyone's time, drove her to fight for a different approach to their writing that reveals how the genre is a written representation of both her professional identity and the values of her field.

When I first began working with Katy, she complained about the meeting minutes as tedious, inefficient, and too long, yet she knew if she did not create them, what would be disseminated would be, at least in her mind, an embarrassment to the company. For the vast majority of the more than two years the project has been in active construction, the process was as follows: the administrative assistant for the project would transcribe the audio recording, a task itself inefficient and time-consuming, then Katy would edit down the transcription to

remove language that she deemed inessential or elements that did not belong in the document, rearranging sections to have a logical and consistent order that could be maintained from month to month. The order was based on what was under Schedule A or Schedule B, then within each of those schedules, what the status was of each structure. While the conversation did not proceed in a linear way, Katy understood that it would make the most sense to arrange the memo following this order, primarily because that is how the structures are laid out in the design plans. The process to revise the minutes into something that Katy felt was presentable took an enormous amount of time from both the administrative assistant and Katy, and resulted in a memo that still deeply dissatisfied Katy.

The source of her dissatisfaction was two-fold: one, she felt that the writing process simply took too much of her billable time that could be better used in more productive engineering pursuits as well as the time it took the administrative assistant to provide the material Katy had to work with. Two, the resulting memo was usually 8-10 pages long and contained huge blocks of text that were too easy for a reader to simply ignore. Therefore, it was likely that few read the minutes despite their potential utility in managing the multi-million dollar project. Legally, her company needed to produce the minutes given the nature of the government-funded project, yet Katy was frustrated by her inability to craft a document that was both efficiently written and actually read and used by the audience. Her keen awareness of the ideal rhetorical function of the document also fueled her dissatisfaction: she knew that minutes needed to be brief and to concisely state what actions must occur after the meeting. The minutes, she argued, were simply not producing the right kinds of action. After the minutes were twice sent out without being revised from what was essentially an error-riddled transcript, Katy fought to make them into something that would accomplish the genre's goal: to summarize the

discussion, initiate action, and to present both herself and her company as competent professionals. Katy shared her feelings:

> To me it's embarrassing. It's really embarrassing. I wouldn't want—now technically, it's not my name on this, [it's the name of the two bosses]. But neither one of them do this, it's actually me. But I have just never emphasized that this needs to be [Katy] submits report. But I don't care at this point. So, yeah, at this point, if that was technically my name on this, I wouldn't want it to leave the office and be distributed to other people because of the nature of language. (1 Nov. 2013)

In response to the minutes being sent out without significant revisions, Katy remarked:

> I was kind of horrified to be honest. But I'm not sure if anyone is reading them. I mean, nobody was like "holy crap, the minutes this month were awful." Because I think everyone that gets it was there, so I think they're probably not like "ooh, let me relive that by reading these 10 pages of minutes." These go in a file, and they're probably filed and referenced only if there is a problem. But I feel like they need to be done, and they need to be done well if we're going to submit them. So I take that upon myself to make it happen. And I probably put way more effort into it than I probably need to. (1 Nov. 2013)

While recognizing that in some ways this writing is fairly invisible, Katy refused to let the minutes be sent out as they were. Although her name is not on them as the author, she saw them as a reflection of her as an engineer, and she struggled to understand why her two bosses would consent to send them out in a clearly unprofessional form. Her motivation in writing them was as much about asserting her standing as a competent professional as it was about crafting a usable document that would accomplish what it needed to do.

The first change was to remove the administrative assistant from the writing process. Because that individual lacked both knowledge of the engineering work that was occurring as well as the rhetorical knowledge of the function of the meeting minutes, Katy argued that she should not have a role in their writing. When I asked Katy why she was the one revising these and not the administrative assistant, she commented:

> Because the person who should be doing it is not doing it to the level that is—yeah, I just don't think it's adequate enough. I was going to say professional—but yeah, it is. I'll also say that it's not *not* professional, but it really isn't professional to put that kind of work out. It makes us sound really ridiculous. (1 Nov. 2013)

The administrative assistant's inclusion was problematic because she often misunderstood the technical knowledge, thus she was able to do little more than repeat verbatim what was stated on the tape, or in some cases what she thought was said that may be incorrect. Additionally, the assistant may have felt that she did not possess the authority to make changes, even if she thought something seemed out of place. Katy was often frustrated by the administrative assistant's inability to notice what Katy changed each month with regard to formatting, naming, and other elements that needed to remain consistent. For instance, with regard to mishearing comments and not questioning what she heard, the administrative assistant transcribed one statement as "Katy asked about a crossword puzzle" (when Katy had actually asked about a *cost proposal*), perhaps assuming that it would be caught if it was in fact wrong by either Katy or her boss, Bob. However, the minutes went out with this statement intact, as that was the one month Bob had offered to revise them and then (maybe) made very few changes. So while the administrative assistant might think something is wrong, given her role in the company and her status as a non-engineer, she may not feel that she is able to make corrections or question what she hears, even if she suspects that it is wrong—she lacks the authority to take initiative to rectify the problem. And Bob himself is not willing to make sure the minutes are professional and usable because in his mind, they are sufficient as they are.[5] Either way, Katy recognized that many of the problems in composing and crafting the document would be solved if she was the originator of the content rather than starting with the transcript.

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[5] The meeting minutes as a location of specifically gendered conflict will be further explored in Chapter 4

By removing the tedious transcription process, Katy was able to write more efficiently, sparking less frustration and enabling her to shape the minutes to a clearer purpose. Instead of working from the transcript, Katy would listen to the meeting recording and select the material that should be communicated in the minutes, concisely summarizing the important information and disregarding the inessential. While one of the firm's principals argued repeatedly that they needed essentially to be a transcript for legal reasons (especially after conflicts arose between the engineering firm and the contractors), Katy knew that they were useless in that format. If someone needed the exact wording of what was said in order to solve a conflict, she commented, they could return to the original recording, which is what would likely occur if a case were ever taken to court. By making these changes, Katy was able to reduce the amount of time she spent crafting the minutes and remove the need for the administrative assistant's labor.

To better understand the evolution of the genre and how Katy actively shaped it, three passages from three different memos concerning the same section have been selected and will be analyzed individually. The first passage is from the transcribed version that Katy began working with before revising:

> **Structure No. 2 – Comminutor Structure** – [Contractor] indicated that no work had been completed on this structure in the previous month and added that it is definitely on the agenda for the next month and will be one of their biggest pushes to try and get it going before they run into a lot of rain.

This sample reveals issues that Katy herself brought up: it is wordy, it contains nonessential information, and it sounds unprofessional. Katy repeatedly expressed how she is embarrassed to send out a document that is essentially the unedited ramblings of people talking—the administrative assistant simply writes down what is said including irrelevant information that occurs frequently in spoken communication. Katy understood that these ramblings are the necessary result of that meeting's context, but how people talk does not need to be displayed in a

written document. Additionally, the idea could be expressed much more concisely and without extraneous detail and without making the contractors sound like they are excusing their failure to make progress. The next sample is Katy's revision of the original:

> **<u>Structure No. 2 – Comminutor Structure</u>** – [Contractor] indicated that no work had been completed on this structure in the previous month but noted that [Company] would begin construction next month.

While Katy remarked that she thought it could be still more concise, it took 24 words to say what was originally 50, and it conveyed the point with a more professional style. Whereas the original makes it seem as though the contractor is equivocating or excusing a lack of progress, the revision states the facts: no progress was made in one month, but their intention is to begin work in the next. Katy's revision indicates her adherence to values of engineering that are at the core of her professional identity, which is to convey the essential elements clearly with an economy of language. She works toward accomplishing that goal with her revisions to ensure that the reader is able to get the facts as easily as possible while also demonstrating that she—and her company—are professional and competent.

The next example exhibits a change in process. No longer did Katy have to edit and revise an existing document; instead, she created the section based on the information in the transcript, and it represents a different style from previous memos:

> **<u>Structure No. 2 – Comminutor/Sewage Acceptance Structures</u>** – Concrete work at this structure was the focus of [Company's] work in December and will remain a priority in the upcoming month. Other items of completed work included excavation (estimated ~ 70% completed), underslab piping, and 48" Line Nos. 201-202 placed adjacent to the Sewage Acceptance Structure. Construction of the Sewage Acceptance Structure in the next month is subject to lagoon levels and access.

Where Katy's earlier version retained the contractor and company in the agent position of the sentence as structured in the original, this sample shows a clearer adherence to engineering

stylistic conventions, where *what* was accomplished is emphasized rather than the doers of that action. Since she began with the meeting recording and a blank page rather than a document that she had to edit down, she was able to transform the writing to better suit what she saw as appropriate and professional communication because she was not bound by what was already on the page. Her use of generic features such as the passive voice reveals a clear sense of the action she needs the memo to accomplish, which is to communicate what happened on the site in the previous month and indicate what should occur in the next month. By using the passive voice here, Katy places the emphasis on the work that was accomplished rather than the contractor or the company itself. The essential information is the progress of Structure No. 2, and she uses the passive voice to clearly convey that, deemphasizing the people at work, which is inessential information. Additionally, although this passage is longer than the previous sample, it packs substantially more information into its 64 words and three tightly written sentences. Each sentence clearly and concisely contains one idea, and each sentence is concise and short, as is the ideal in engineering writing. When compared to the wordy, agent-first sample of the unrevised memo, or even to Katy's revision, this example illustrates Katy's understanding of the genre conventions and displays her use of writing as an assertion of her engineering identity. Just as she values efficiency in her work as an engineer, she too creates writing that is efficient and concise. This passage is in line with standards for good engineering writing, and Katy created a clearly professional document while also underscoring her own identity as a committed and capable professional.

Besides reducing staff time spent on writing the minutes, Katy also worked to make them more usable, a value in line with her writer identity and her understanding of engineering discourse. Because the minutes were so long and contained too much information even after she

revised them, they were not being properly used to communicate the present state of the project

and to initiate action. To rectify this issue, Katy added "action items" to summarize and call

attention to appropriate items for each structure, enabling the reader to quickly understand what

needed to be accomplished in the upcoming month. In the new format, the status of the various

structures was quickly followed by sections that examined the project more broadly, such as

"Scheduling" and "Submittals." Each section contained a longer description of what was

discussed in the meeting, immediately followed by concisely worded action items that were

offset by bullets, as illustrated below within the section titled "Commissioning and Start-up:"

> [Company's] schedule projects a project completion date of [X]. [Contractor]
> notes that [Company] has begun scheduling start-up (commissioning) of
> equipment. Commissioning of blowers and Structure #6 VTSH pumps anticipated
> to occur within 60 days (early [X]). [Contractor] projected Schedule B units
> would be online (water flowing through plant) [on X]. The commissioning
> process and coordination of start-up and scheduled training was discussed.
> [Company] anticipates start-up on this project to be easy.
>
> [Company] will perform a hydraulic test on the MBBR structure with potable
> water prior to placement of media. [Product company] is preparing instructions of
> media placement sequencing for [Company]. [Contractor] noted that the blowers
> must be running for the media to be placed.

Katy is conscious that this longer description is essential to conveying the important points of

what occurred during the meeting, but she also is aware of her audience as she crafts this

document. Because few individuals will read the memo from start to finish, she began adding in

action items after each section, meaning a reader could skim the full description and skip straight

to the action items. For example, the action items for this section are as follows:

> **ACTION ITEMS:**
> - [Company] to communicate equipment commissioning dates to [Engineering
>   Firm] for coordination with City.
> - [Company] and [Engineering Firm] to hold meeting to discuss start-up
>   sequence and coordination in [X].
> - [Engineering Firm] to prepare summary of specified manufacturer's field
>   services required.

Given her own identity as someone who values efficiency and a writer who constantly thinks about her audience, these action items are an essential element of the genre, and one that she was finally able to implement when she gained full control over the writing of the minutes. The action items concisely summarize what is essential to know and what needs to be completed; in other words, the memo becomes a vehicle for action. In addition to providing a brief summary for a rushed reader, however, the style of the action items also underscores their nature. The syntactical construction of the items—agent plus infinitive verb plus object—reduces the items to who will do what action. This concision and economy of words is the hallmark of engineering communication, and serves the very real function of clearly stating what must occur. Her goal is to not be concise for the sake of concision; her main purpose is to communicate the main ideas to readers in a way that will actually be used rather than ignored or simply filed. Katy's shaping of the meeting minute genre reveals her rhetorical awareness of what this writing can be used to accomplish as well as her own values as an engineer.

As Katy refined the process of crafting the meeting minutes, she demonstrated a rhetorical awareness that came not from formal training but from her earned rhetorical knowledge. Joanna Wolfe (2006) addresses the rhetorical nature of the meeting minutes genre and the ways that minutes go unaddressed in professional communication courses. In her examination of a sampling of technical communication textbooks, she found that none of the textbook writers establish distinctions among different types of meeting minutes (transcript, action-oriented, and parliamentary style), nor are they presented for their rhetorical function (Wolfe, 2006). In interviews with three professional engineers with extensive managerial experience, Wolfe (2006) found that minutes did indeed function rhetorically within an organization: they "provided a regulatory function by holding people accountable to

commitments and by preventing the team from reopening old debates" (p. 358). Furthermore, she stressed that the minutes were not written by secretaries but by the engineer or professional deeply involved in the project as "the note-taker needs to understand the content and context of the conversation in order to translate team decisions and actions into a form that accurately reflects the will of the group" (Wolfe, 2006). These findings expose precisely the original problems that Katy encountered and how she was able to manipulate the genre in order to solve those issues: the minutes should not be created by an administrative assistant who has little technical knowledge, and they should be in the format most appropriate for the organization, which, in this case, is the action-oriented genre. By adding in the action items, Katy was able to clarify the actions that needed to take place and present them as a group consensus. Although there were issues and conflicts among individuals and between different entities within the group, the meeting minutes do not expose those conflicts, instead presenting the image of a project that is progressing steadily and providing the actions needed to continue to progress (Wolfe, 2006). Katy understood what these meeting minutes needed to accomplish and called on these elements of the genre to better communicate the ideas to the group. Additionally, after changing the writing process and the genre of the minutes, Katy did receive feedback from her readers, who appreciated the new format for its readability and accessibility, comments that indicated that they were now being read and serving their purpose. Katy based these changes, however, not on her formal training in professional writing, but instead on her rhetorical knowledge as an engineer who not only identifies strongly as a writer but is also deeply aware of the connections between how information is presented—genre—and the audience targeted by her documents.

Coauthored Research Article—Christine

An experienced and prolific researcher, Christine primarily writes research proposals,

conference papers, and journal articles, though her functions as the current director of a research

center and an associate dean have shifted her focus toward administrative writing. As she would

comment in the intake interview, she was a competent writer especially when compared to her

peers, and has in fact received several best paper awards for her writing. She was keenly

conscious, however, of what the research paper or the conference paper was supposed to *do*, or

the action it was to accomplish in her professional community. She remarked when asked about

the amount of writing she does, which varies, but is significant: "But a lot of what I do, but, you

know as a researcher, a lot of what I'm doing is generating content that will then be written

about" (23 June 2014). In reference to the writing that emerges from that work, she said:

> In the research, there's lots of writing. We do modeling, and we do data analysis.
> A lot of my students do the bulk of that work, right, so I give them the guidance,
> and we may go out and have meetings, but they're going to analyze the data once
> I give them instructions on how to do that. So a lot of what I do involves writing
> the proposals to get the funding because a lot of our work is funded through
> grants, so I write the proposals to get the money in. [And I write] monthly,
> quarterly updates to the sponsors. And then in the context of the writing, we write
> conference papers, we write journal articles. (23 June 2014).

She would go on to explain about the nature of the research article. Rarely is she the sole author,

and who is credited as first author in a research article is not necessarily who does the most

writing but who generates the most *content* or offers the greatest contribution to the knowledge

that is being communicated through the article. She remarked:

> It's almost like writing it up is almost an afterthought for us, which I know is so
> different for you. But from our standpoint, we will have models and code and data
> and tables and analysis, and this body of work that's like this and now we're like,
> how do we get this into a 10 or 15 or whatever page paper […]So it's rare that
> we're changing the world with what we're writing about—it's more there's some
> tables, or there's a new model, or it's the way we did the literature review […]
> For my students, it would be their model that they created, or the way they

analyzed the data or their methodology that they're putting out for the world. The paper itself is just the vehicle to communicate the real contribution of what they're making. (23 June 2014).

The idea of writing as a vehicle for the knowledge that's been created through the data analysis or model creation is consistent with the ideologies of scientific research where the writing is believed to simply be the narrative of what happened.

In this sense, the author(s) are secondary to the contribution offered by the writing, thus Christine's argument that the writing is the tool to convey the knowledge demonstrates her understanding of the generic conventions at work and their relation to her identity as an engineering researcher. Scientists frequently claim that good scientific writing is clear, it conveys facts without embellishment, and it avoids the use of persuasion, an ideological stance that rhetoricians of science push against in their examinations of scientific texts (Gross, 1996; Ceccarrelli, 2001; Myers, 1990; Winsor, 1996). While Christine is conscious of the need to tell the story of the research clearly and compellingly, her insistence that writing is simply the tool to convey that story is consistent with a scientific ideology that seeks to present new knowledge in a disinterested way. It is telling that she distinguishes her work from her understanding of what is done in English or writing studies, a comparison that she continued throughout our initial discussion, and one that will be addressed later in this chapter. These distinctions reveal Christine's genre awareness as well as how she understands writing genres to be a representation of professional identity. Her writing is not meant to engage or entertain, though it is meant to communicate, to inform, and to offer a contribution to the field.

The article I interviewed Christine about was coauthored with another researcher and focused on the application of a tool for emergency management, specifically in rural communities. Our discussion revealed Christine's awareness of its place within the frames of

academic engineering. In addition, she alerted me to the elements she particularly attends to as a writer, indicating her attentiveness to her readers' needs as well as her preferences as a writer. While Christine continuously emphasized the ways the written article is a vehicle for the knowledge that resulted from the research, her choices as a writer are rooted in her understanding of what the article could potentially accomplish and are indicative of a thoughtful author, aware of the genres available to convey the developed knowledge. I purposefully selected a recently published article where Christine was the first author with just one other coauthor, thinking that it would make it easier to understand who wrote what and to assign the contributions, but Christine quickly corrected how I thought of authorship for this piece: it was the product first of a grant and a master's student's thesis work, then it was heavily transformed from that initial work and crafted into the published article. However, the article was simply one piece of the written work, as there were other products that emerged from the research including a report, presentations, interactions at conferences, websites, and other genres used to disseminate the information. This particular genre, the published research article, was written to fulfill what Christine referred to as "our academic needs" (20 Jan. 2015). She told me she looked at her research "more holistically" (20 Jan. 2015), thinking about communicating the work not simply to other academics or the practitioners who might read a journal article, but also to those who might encounter the work in less formal ways as well as the knowledge her graduate students, particularly those at the master's level, will take with them into their professional positions.

It is Christine's awareness of the broader context for her work that influences how she crafts her articles; it also demonstrates the potential misstep of only examining academic articles as the metric for research productivity or as the only genre that matters. In other words, they are the primary written product, the most visible genre available, but these articles are not the only

means of communication available to an academic engineer. Since she was aware of the variety

of genres available to her, Christine understood the research article as necessary for academic

researchers and as a way of demonstrating her research productivity within the academy, but it

was also limited in its ability to convey information to practitioners or the people who might

actually use the tool examined in the research article. In this case, Christine was conscious of

how she was actually writing to both academic engineers interested in emergency logistics and

engineering managers who work within the transportation sector, and that awareness allowed her

to shape the genre to meet the demands of these particular audiences.

As she points out, because engineering is such an applied field, often journals will be

geared toward audiences that demand an application of theory, and if a researcher wants to have

a paper accepted by that publication, they must include a clear application of their research:

> It really pays to know the literature, to know the audience of the journal you're
> writing to. So basically if you know you're writing to mathematicians who
> happen to read operations research journals once in a while, then you better know
> that they want to see like 90% equations. Which I don't write, but if you were that
> kind of writer, that's what you would see. So you just need to know from the
> journal—one of the journals I write for, it has a section called like "practical
> implications for engineering managers." They are not going to publish a paper
> that cannot do a good job in writing in that paragraph. And if you struggle to write
> that paragraph, then you shouldn't be submitting that paper to that journal. My
> work is in transportation, it tends to be more applied, so I've always kind of
> known to get funding or to get people interested or to kind of motivate people to
> care, you know, it always did have an application. Because people use it,
> everyone uses it. People are interested in it. I think it does depend—and you'll
> see, I sit on editorial boards of journals, and people write stuff, and you think
> you're just completely missing your audience. You're writing so simple that no
> one who reads this journal will care or you're writing about technical details that
> most people won't care about. It just depends on the targeted audience of that
> journal. (20 Jan. 2015)

Given engineering's particularly applied focus and the research that she publishes, Christine is

aware of the need to write to a dual audience for some publications, which affected how she and

her coauthor crafted the paper we discussed. The challenges of reaching a dual audience are

explored by Leah Ceccarelli (2001) in her examination of three scientists who used their writing to appeal to two distinct audiences using polysemy and what she calls conceptual chiasmus to reach each reader. These two strategies enable readers to understand the same text from different perspectives, while the author uses it to reach them with different appeals (Ceccarelli, 2001). While Christine and her coauthor do not have to appeal to vastly different audiences, they do have to account for the distinct needs of an academic engineering researcher and an engineering manager/practitioner. She remarked:

> In this case, it's kind of a balance. I mean, sometimes I'll write things that are targeted completely for practitioners and they do not care about the technical details, the model, the type of computer that you ran it on, how fast the code ran—they don't care about those details. They just want to know, practically speaking, what are the lessons learned or what are the takeaways. But then if you're [writing] to an academic, they would like the code. They want all the details of what happened. So in this case, it's kind of like a fine line between providing enough that a researcher could repeat it if they wanted to or at least know enough that they could reach out to you with questions. Or that a practitioner could read it and say "oh that's kind of interesting. I never thought about using that." (20 Jan. 2015).

Each set of readers will be reading the article for a different purpose and using the information differently, so the writing itself must balance these readers' needs while also offering a contribution to the field.

To accommodate this dual audience, the authors do not use the standard research article IMRaD (introduction, methods, results and discussion) organizational structure expected by academic STEM researchers, though the article does contain some of the same moves. The authors introduce the topic, do an analysis of the available literature, and propose their tool. The nature of the contribution, however, is key here: Christine informed me that what was valuable about this publication was not the decision analysis but the tool they developed out of that analysis: "What was creative was taking it and applying it to a field that no one had ever thought

about trying to do in a way to help people who do that kind of work do it better" (20 Jan. 2015).

In this sense, the application was the contribution rather than an experiment that led to new

knowledge, thus the genre itself had to accommodate that information. Despite its organization

into different sections than a typical IMRaD-style paper, the article does still fall within the

research article genre in terms of the general moves that it makes. It introduces the problem,

explores various approaches through a literature review, then offers a tool for emergency

managers to use to deal with disasters with regard to transportation. They also include the

mathematical formulas that they used to compute their value analysis, formulas that may not be

of particular use to a practitioner but would be necessary for an academic reader. These aspects

would appeal to the academic researcher who would expect a thorough grounding in current

research as well as certain kinds of analysis all written within the guidelines of acceptable

scientific prose.

In addition to the use of genre features to appeal to the academic reader, Christine and her

coauthor also include figures and tables to enable the practitioner or manager to understand the

tool and its potential applications. They use figures to visually represent several hierarchies and

scales, as well as to detail the process they recommend for use. In this case, the visuals serve two

functions: they are a feature of the academic journal article and would be expected and accepted

by an academic reader, yet they also organize the information in a more easily understood way

for the practitioner needing access to the information. The score card they examine is also placed

within tables, which makes it more quickly accessible for someone looking to apply the tool they

have developed within the article without having to read long paragraphs. Christine certainly

recognized the power of tables and figures:

> Without it being distracting, I try to use figures and tables as much as one can. If
> I'm going to write about a methodology, then I'm generally going to have some

kind of figure in there so that someone can follow along as opposed to just
paragraph after paragraph after paragraph. (20 Jan. 2015)

Those visuals become a primary way she and her coauthor use the conventions of the academic research article to simultaneously appeal to both audiences and convey their contribution to the field and its application.

This particular article provided a glimpse into the writing process of a research-active engineering faculty as she managed a research project with graduate students and collaborated to write, submit, and eventually publish this research. The article I used was coauthored in that multiple people made contributions, yet Christine commented "in this case, I wrote almost every word of the paper" (20 Jan. 2015), though she would later clarify that there was some back and forth with the coauthor who was also responsible for the coding of the tool. The article becomes a representation of her identity as a research engineer in that it represents a systematic approach to a problem, which she pointed out was characteristic of her as a researcher and writer, as well as demonstrating her ability to use genre to convey information to a dual audience. She saw this article, however, as "pretty typical" and not particularly creative, acknowledging that the writing itself is not what sets published piece apart: "The work itself is what makes it unique" (20 Jan. 2015).

Design Report—Emma

Unlike that of Katy and Christine, Emma's professional identity was in development, evident in her discussion of her writing. As a sophomore biological engineering student, Emma's initiation into the world of technical reports began in her biological engineering design seminar where she was asked, along with three teammates, to construct a series of reports. This course was an experience that has been formative for her engineering and writer identity as well as her growing awareness of the communication potential of technical reports, or what these reports

could *do*. The report we discussed, titled "Waste-Removal Report," was the group's final report which detailed the results of an experiment to develop a system to remove waste from a fish tank. It received a 95%, indicating that it was "better than what he would expect" (16 Dec. 2014) according to the evaluation criteria Emma shared with me. As a student, Emma was aware that this report was meant to demonstrate learning in a classroom setting, though she did attempt to link the writing she did in this context to workplace writing:

> [The design report is] basically an evaluation of how we applied what we learned in class over the design process and if we actually used it or if we came up with another method to design the waste removal process. It's as if [our professor] was our boss, and we're giving him a summary of why we used these materials to build this product. (16 Dec. 2014)

Her consciousness of the dual nature of the report—both educational and proto-professional— indicates her understanding of the rhetorical situation in which the writing takes place and which shapes her and her group members' response to the assignment.

In their study of writing-intensive STEM courses at MIT *Learning to Communicate in Science and Engineering*, Mya Poe, Neil Learner, and Jennifer Craig (2010) explore the connections between the development of a professional identity and the writing students produce in a school setting. Their argument is rooted in social theories of learning that recognize that "identity is socially constructed through a person's interactions with others, and knowledge, and with the physical and symbolic elements that he or she uses to communicate" (Poe, Learner & Craig, 2010, p. 9). They also note that while genre theory, with its attention to social context and dynamic interactions between form and a community's needs, should inform a classroom that links writing to an emerging professional identity, too often is school-based writing reduced to static forms:

> In other words, students learn "what" but rarely are offered the "why" or the knowledge production possibilities essential to a genre approach. For example,

the long history of the school-based laboratory report as a "plug-and-chug" format or regurgitation of content in static forms ignores the critical role of the scientific report within the discourse communities of scientists. (Poe, Learner & Craig, 2010, p. 9)

This context is the one that Emma and her group members operate within, and it offers the potential to enable her to better understand what it means to be a biological engineer if she is able to capitalize on the opportunity. Poe, Learner and Craig (2010) found that students who looked at writing as a matter of knowledge transfer were less successful than those who understood its communicative possibilities and connection to authentic writing tasks that they had or would encounter. They discuss Jake, a student with a strong sense of himself as a scientist even while that identity was shifting, who demonstrated his ability to make connections and meet new writing challenges: "his confidence that he could take on new identities and learn new rhetorical situations (and, perhaps most important, recognize them as rhetorical situations) resulted in a strong performance" (Poe, Learner & Craig, 2010, p. 48). For Emma, her discussion of the report indicates that she did in fact recognize the future possibilities for the writing that she produced for her design course.

One way that Emma indicated her awareness of the future uses of writing was in how she characterized her audience. While she did cast her professor as the audience, she characterized him not as an instructor but as an *engineer*. I asked to her to elaborate on the distinction:

I just don't like the word instructor because it makes me feel too much pressure, like I'm going to be criticized too much for my work. With other engineers, though, I feel okay showing my failures and showing I didn't do it perfectly because as an engineer, I feel like we're going to make mistakes and everything, but when I say the word 'instructor,' that's when I feel like I need to be perfect and that kind of scares me. (16 Dec. 2014)

By reading her professor as an engineering reader, she could then approach the criticism he provided not as an indication of a lack of perfection but as part of the discourse of how engineers

communicate with each other. The criticism provided was thus read as conducive: "It's constructive criticism, though, and it doesn't determine how good of an engineer you are. It's like part of the engineering process, the learning process" (16 Dec. 2014). The distinction she draws allows her to call on her engineering identity to approach learning situations, and she places feedback and criticism firmly within engineering practices instead of purely schooling context. Like Jake, Emma approaches the course's written assignments with an eye towards its professional purpose, and her identity as a biological engineer influences how she interacts with her instructor.

The report that Emma shared with me was the final report for her sophomore-level biological engineering design course, written with three other individuals, two men and another woman, Casey, whose ability to write technically Emma greatly admired. Both the project and the report were done collaboratively: the report sections listed on the assignment prompt were divided among the four members. The night before the assignment's due date, the group was supposed to get together to pull all the pieces together, but one team member left shortly after they met because he had a test and the fourth couldn't make it, so it in the end, it was Emma and Casey, the two women, who preparing the final draft for submission. I will examine the gendered nature of the division of labor on the group project in Chapter 4, as well as how Casey became a writing mentor for Emma in Chapter 5; however, what is important to note here is that Emma viewed this assignment as a chance to learn to work collaboratively, a skill she recognized as essential to engineering work because she had already participated in collaborative writing in creating the grant proposal for the Clinton Global Initiative funding.

Because the report did not undergo extensive revision by all members of the team, it is possible to isolate the sections that more belonged to Emma, although it would seem that Casey

edited and provided feedback on those sections as well. Using the text as well as Emma's post-writing commentary, we can see Emma's growing awareness of the generic features of the technical report as well as her assertion of her own identity. The first indication of her awareness of textual features and why they are used was when she identified the primary author for various sections. She noted where suddenly what was bulleted went into paragraph form and mentioned that the paragraphs should also be bullets, but they missed it when they were revising. Part of the problem was that her teammate, Andrew, neglected to elaborate in the bullets:

> Well he actually did do bullets in the very beginning, but the way he did it was […] his brainstorming. Like he did a bullet BOD, or a bullet pH, turbidity, but he didn't explain that we need to keep a low pH or a high turbidity, a low BOD—he didn't go into detail about why we need those. And we told him to go into more detail, and he took it out of bullets. (16 Dec. 2014)

In fact, the professor's comment was that these sections did indeed need to be bulleted, and Emma understood why: bullets enable a writer to be "more concise" and not have to worry about the internal connection that should occur in paragraphs. Emma commented, "You know how paragraphs are supposed to flow into each other? Like this sentence leads to this sentence. Well, you can't do that when you're listing" (16 Dec. 2014). And what Andrew provided would have been more clearly and concisely stated in bullets, but the trouble was that he didn't seem to understand that a bulleted list could in fact be more than a word or a phrase—they were constraining to his ability to elaborate. Emma (as well as Casey), however, understood that the bulleted lists would have been more effective for these sections and would have enabled them to convey the required information more clearly. In effect, the bullets constrained Andrew in ways that Emma and Casey both did not encounter in their writing; while all three were familiar with the essay paragraph they encountered in other academic contexts, Emma and Casey understood the variety of formatting options and could select the most appropriate. It would seem Andrew

could only list without detail or paragraph with too much content, and neither was appropriate in this context.

While this particular report was not precisely an instance of the IMRaD genre, Emma indicated an understanding of many of the features common of this typical STEM genre and its connection to a professional identity. Research articles written for scientific journals are formatted using these or related headers, which also functions to establish specific sections that perform specific action (Swales, 1990). When I inquired about the formatting choices, Emma immediately explained:

> If you were an engineer, and you wanted to go to the design section, then you could go to "design" and if you wanted to go to materials to find what materials you were using, then you could go to "materials"—that way you don't have to read every single paragraph. If you already know how to put it together, you already know what the materials are, then you could go straight to the conclusion and the results and the evaluation of the data and whatnot. (16 Dec. 2014)

Emma's understanding of formatting conventions highlights her knowledge that the genre enables readers to read efficiently and jump to the sections they find most crucial. She is conscious of how formatting can facilitate easier navigation of the text, a feature that is part of the social context. STEM readers often do not read research articles or reports in order; they will frequently skip to discussion and conclusions and read nothing else, or read the sections out of order, depending on their purpose for reading. Emma does not cast the use of section headers as a requirement of the assignment—and therefore an arbitrary feature—but instead as necessary for the reader's use. She makes the connection between the school-based report and what a professional reader would expect from the report, and demonstrates an understanding of professional expectations that affect how she will write as an engineer.

An analysis of the writing in the section Emma primarily authors reveals her growing awareness of another element of the report genre: the relation of the writing to visual elements.

Emma constructed the methodology and conclusion part of the report, where she described the

materials, components, construction, and reconstruction of the fish tank as the group encountered

and solved various problems. The following is the description of their initial design:

> From the fish tank under the table, the water is to be pumped out into a large
> cylindrical drum (sand filter). After being filtered, the water will drain into
> another, connected drum (overflow), before being pumped up from the overflow
> into a smaller cylindrical bucket (bacterial filter). The bacteria filter is to be
> placed on a small stool (on the table), slightly higher up than the "plant bucket."
> The water from the bacteria filter will then drain into the adjacent plant bucket,
> before finally flowing back down into the fish tank.

She then directs the reader to examine a figure in the appendix for a visual representation of the

design, but the figure was lost as the document was transferred among computers and word

processing systems. When asked what she might do differently in the future, Emma immediately

pointed to the need for more sketches and described the frustration of attempting to write the

description. She commented,

> [Figures] would have made it easier for the engineer to read and look at because
> you learn so much more from pictures instead of words. Also it would have made
> it so you wouldn't have to rely so much on explaining in detail in paragraph form
> because you could just say "look at the picture." (16 Dec. 2014)

The reason she struggled through the description, however, was because initially she didn't think

she could use images before coming to the realization that "duh, you can include pictures" (16

Dec. 2014). Emma's frustration with this section demonstrates the struggle many students face as

they shift from primarily writing in genres where images are either discouraged or not explicitly

taught to a genre where images are a necessary feature of the genre. She explained:

> I knew I needed it in there to make it easier for him to look at, but then again, it
> felt like I was cheating, like you had said. Because that's not writing—you think
> that writing has to be all words, you don't think of writing as a mixture of pictures
> and words, you know. When you think of pictures, you make it seem like a
> children's book. Like when I think of textbooks, I think of thick, words, like no
> pictures, just a bunch of words. But that's not real life textbooks—a lot of
> textbooks have a lot of pictures and a lot of diagrams to explain and a lot of

graphs. But growing up, that's what they teach you to use the textbook—you start off with a kiddie book with a whole bunch of pictures, then you move up to books with no pictures. (16 Dec. 2014).

In the future, she commented that she will be sure to include more figures because of their utility in visually representing concepts not easily reduced to a concise description, as well as her realization that they were a feature of engineering written genres.

Emma's own analysis and evaluation of her writing a month after submitting the report also reveal her growing genre awareness, as well as her realization that while this is meant to imitate professional writing, it is still a school document. When I asked if the report accomplished its purpose, she remarked, "In that class, yes, but in another class no. Because we were compared with our classmates and against their level, so depending on the level of the paper, it's completely different than the level of the class" (16 Dec. 2014). She could identify what should be done better in future reports, but also noted:

> I felt like it was effective. Because it showed our, that we were able to use a weighted objectives table, how proficient we were at using it and it also showed how much we followed the design process. Because there was a design process, there's an actual formula which I think is pretty awesome, like an actual method to this madness. It also showed [our professor], since he'll be our teacher in other class, it also showed him, it gives us a base of how we're going to be improving throughout our education, you know? (16 Dec. 2014)

Her knowledge that the stakes for this assignment differed greatly from a professional context allowed her and her group members to turn in a "good enough" document that greatly differed from the high-stakes writing that Emma had produced in order to earn the CGI grant for her student organization as well as compete for scholarships. She was conscious of the classroom environment as its own space. As Poe, Learner and Craig (2010) point out, while the classroom is not a professional setting and therefore is missing some of the authenticity that can motivate

students, the classroom does permit students to begin engaging with some of these writing skills.

Furthermore, they argue:

> Writing classes have perhaps been unfairly criticized for this inevitable
> abstraction or lack of transfer or specific skills, but once again, recognizing the
> larger goals of professional preparation is key here. Students will learn to write as
> scientists and engineers by engaging in professional tasks. That writing, of course,
> will inevitably be professional-like, a novice approximation of the skills they will
> bring to bear on those tasks once they have the full benefit of experience and
> additional instruction. (Poe, Learner & Craig, 2010, p. 193)

The problem, they note, is that students may not always directly connect their classroom learning

to the professional tasks they face in the workplace. Emma, however, seemed to understand that

there were important lessons to be learned from the writing she produced in the design class

when she treats it simultaneously as a school and as a proto-professional text. Her genre

awareness helps her not only succeed on the design report, but indicates her potential to produce

professional texts in the future.

Although each document examined here represents a collaborative effort—or is the

product of multiple writers and voices—Katy, Christine, and Emma understand the function of

writing within engineering and value its importance as a tool to communicate, to share

knowledge, and to demonstrate understanding. Their discussion and manipulation of text also

indicates either a burgeoning awareness of what it means to write as an engineer (as in Emma's

case) or a clear awareness of the actions that writing allows the authors to take within their

specific discourse communities. Writing within specific genres and understanding how those

genres facilitate action within their professional organizations permits these individuals to take

up their identity as successful authors within their specific contexts. Their unease with the nature

of these genres when compared to the literary works they consume is indicative of their genre

awareness as well as their subject position in this research, which I examine in greater detail in

the final chapter. Despite that unease as they talked about their writing with me, their performances and their understanding of the nature of those performances reveal their genre awareness and their writing knowledge.

Gender and Genre

Discussions of gender can be linked to genre in terms of cultural associations and the forms permitted to women. Historically, women have been granted or denied access to specific genres in order to marginalize them or assert authority over them. Women were also associated with certain genres, such as the diary and the letter, that are private rather than public, versus the public genres that have been and are often currently still dominated by men (Gannett, 1995). Written genres in the STEM fields emerged and developed in times when women scientists were scarce or their writing was submitted under a male name or not recognized as legitimate science (Watts, 2007) and women still continue to struggle to publish as prolifically as men. Indeed, as West *et al.* (2013) indicate, publication trends reveal the prestige areas of study even within fields that may seem equitable overall; areas of higher status will be dominated by male writers.

While genres can be used within communities to marginalize women, deny access to female writers, or otherwise prevent women's full professional participation, women within a specific discourse community can also manipulate genres to resist dominant ideologies, argue for different approaches, or stake out professional ground. Risa Applegarth (2014), for instance, examines the development of a number of genres that represent what she calls a "counterstory" to the dominance of the ethnographic monograph in anthropology (p. 8). As a genre, the ethnographic monograph was a form that held the most potential to marginalize women and minority anthropologists and was caught up in the move from an "inclusive" science to a rigorous and professional community of practice (Applegarth, 2014). To resist research methods

and genres that developed out of ideologies of colonialization in the nineteenth and early twentieth centuries, women utilized alternative genres to present a different vision of anthropological knowledge or to present themselves as full members of a professional community where they might in reality be pushed to the edges (Applegarth, 2014). These genres resisted and subverted the professionalization anthropology was undergoing and represented "an alternative scientific practice" (Applegarth, 2014, p. 8) that these women consciously employed in their own research.

For writers in STEM fields such as engineering, sensitivity to genre conventions is another way to assert membership within a community that may attempt to push them out. If participants can speak (or write) the language, then their identity as professionals is solidified. Women in particular may have more motivation to master generic conventions to prove, yet again, that they possess the competency to work within engineering. Additionally, as Applegarth (2014) demonstrates, writers can use their genre awareness to navigate professional situations and to negotiate for authority. Katy's use of the meeting minutes genre, for instance, demonstrate her status and identity as a competent professional. These links between gender and genre might prime women to understand how genres operate in professional contexts and possibly lead to greater sensitivity to their possibilities in acting in those settings.

In the context of this study, Katy, Christine, and Emma all displayed an awareness of genre conventions that could not be explained by explicit instruction. To my knowledge, none of the participants had been exposed to rhetorical genre theory that might enable them to think about genre more broadly, yet their writing and their discussion indicated a metacognitive understanding of genre and communication that enabled them to write appropriately and skillfully in their given contexts. One explanation for their ability to navigate various genres

successfully can be attributed to their educational experiences, which, in part, is connected to their identity as women and the possibly gendered interactions within formal schooling settings. Primarily, if women are encouraged to read and write more in school, then they are exposed to more forms of writing before they even enter college, and they may even write in more genres than their male counterparts. These educational experiences are not limited to women—and future research will compare men and women with similar educational backgrounds who do in fact identify as writers—yet, their experiences may simply be *more typical* of women who pursue engineering degrees. As I explore in more detail in the following chapter, these women's writing ability and rhetorical awareness are many ways an advantage and have helped them attain success, though writing also presents a potential barrier, as I will examine in Chapter 4.

These stories reveal a complicated relationship between writing and professional practice. While all three of the participants believe themselves to be writers, they say it carefully—after all, they do not write literary texts, or the sort of books they each love to read. Instead, their writing is contained within genres that have specific purposes within their engineering, professional, and/or academic discourse communities. Strangely, then, these women seem to struggle with the notion that they are writers, though they clearly think metacognitively about writing and its function within engineering. Each participant moves adeptly from genre to genre, discussing appropriate style and showing that they make choices to appeal to a specific audience to accomplish their purpose. Yet they are uneasy directly claiming their identities as authors because the writing they produce is so clearly non-literary that it should not be compared or assessed in the same ways. When assessed on its own terms, the writing these women produce is skillful, revealing their careful attention to detail and their awareness of what writing can *do*. As Katy's case reveals, writing can be used to assert authority within an organization; it is her

assumption of a writer identity—her genre awareness—that enables her to take action and attempt to change the accepted method for communication.

In the next chapter, I will examine how this assertion of authority or claiming of rhetorical knowledge may open doors for women to find power within an engineering setting, a setting that may undercut their authority or undermine their abilities. These women's rhetorical knowledge paves the way for their success through their ability to manipulate genres to best achieve their goals. With their diverse educational experiences and their metacognitive awareness of genre, all three participants are primed to enter writing situations with the ability to assess the audience's needs and how they can utilize writing to accomplish the action necessary in a given context. While Katy, Christine and Emma are each conscious of how the texts she produces are contrasted to more literary or creative genres, it is ultimately each woman's ability to understand herself as a writer situated with an engineering context that gives her access to the rhetorical resources necessary to write successfully.

Chapter 3

Patching the Leaky Pipeline: Writing and Professional Success

It is well-documented that women entering male-dominated fields, especially STEM, must work harder to be perceived as equally skilled as the men they work alongside (Bix, 2013; Gornick, 2009; Layne, 2009). Combined with the tendency for the women entering STEM to be higher achieving on average (Metz, 2007), this work ethic can translate into professional success and recognition. In fact, Katy and Christine commented that they made sure that their work was higher than the acceptable standard, and all three noted they understood that women sometimes had to do more to be recognized. For example, in our discussion of the challenges women— especially mothers—may face in engineering, Christine pointed out that she always made sure she did more than what was expected: "So I just try to make sure if they said I had to publish 1-2 papers a year, I just made sure I did 2 or more. I just tried to make sure that there wasn't even a question" (26 Jan. 2015). She talked at length about knowing that she had to work hard enough that no one would doubt her ability to be productive while also having four children (one born in graduate school, one pre-tenure, two before her promotion to full professor). Emma also commented that she understood that women were perhaps willing to work harder to make it in the engineering field, which seemed related to her success: "I think females have the highest grade in that class [biological engineering design] compared to males. And that's just because we work harder. And we take it more seriously" (16 Dec. 2014). As these comments indicate, Christine and Emma had a strong work ethic that provided the motivation to ensure their own success. Like Christine and Emma, Katy's strong work ethic meant that every task she took on, she did as well as possible: "I think [my] strong personality makes me want to do a good job […] whether it's gender-related or not, I tend to do a better job than some of my compatriots for some

reason" (17 Dec. 2014). With their attention to a reader's needs and their strong work ethic, writing was the vehicle the participants used to display their professional competence within their academic, workplace, or schooling setting.

In Chapter 1, I argue for the need to focus specifically on women in engineering to examine both women's experiences as professionals as well as the earned rhetorical knowledge engineers possess. In Chapter 2, I focus in on the connections between writing and identity and the ways each of the participants uses their genre awareness to actively construct documents that function as a form of social action, arguing that a connection between gender and genre may influence their understanding of how genres can be used to act in a given context. While writing has the potential to expose women in engineering to various professional pitfalls (which I will examine in Chapter 4), communication skills open doors for women to demonstrate their ability and professional capacity. In this chapter, I examine how each participant's emphasis on reader-centered writing, when paired with her work ethic, allows her to exceed expectations and to secure her place in engineering.

Reader-Centered Writing and Success

Given each woman's awareness of her need to work hard to obtain professional recognition, her carefully constructed writing facilitated her individual success. One of the features that set each participant's writing apart and enabled it to accomplish its purpose was her ability to carefully construct her documents to appeal to specific audiences, or to craft reader-centered writing. In their examination of struggling student writers, composition researchers have distinguished reader-based prose from writer-based prose. Linda Flower (1979) defines writer-based prose as

> a verbal expression written by a writer to himself and for himself. It is the record
> of his own verbal thought. In its *structure*, Writer-Based prose reflects the

associative, narrative path of a writers own confrontation with her subject. In its *language*, it reveals her use of privately loaded terms and shifting but unexpressed contexts for her statements. (pp. 19-20, emphasis in original).

Flower (1979) uses the concept of writer-based prose as a lens through which to understand how and why students struggle to write appropriately for others outside themselves, namely an academic reader. Her argument is that these writers need to understand how to create reader-based prose instead, which she defines as "a deliberate attempt to communicate something to a reader…in its language and structure Reader-Based prose reflects the *purpose* of the writer's thought" (Flower, 1979, p. 20, emphasis in original). Nancy Sommers (1980) also draws on this distinction to explain how experienced adult writers approached revision as opposed to student writers. In other words, more skilled and experienced writers are more likely to approach writing as a reader-based task, focusing outward on the reader than inward on themselves as a writer. While the reasons a writer might fail to appeal to a reader is more complex and must account for a variety of factors such as genre and sociopolitical factors, the distinction both Flower (1979) and Sommers (1980) draw is useful is beginning to understand why some writers are successful.

In the context of this study, the concept of *reader-centered writing* offers an explanation for how the participants approached their writing. Reader-centered writing represents an orientation in writing that is characterized by an author's attention to who is on the receiving end of a document as she manipulates the features of a genre to appeal to that reader or readers. In explaining the choices they made or what they wanted to accomplish, each of the three women would return to the notion of the audience or the reader. They all used reader-centered writing as a strategy to shape their responses to the variety of rhetorical situations they encountered. In appealing to their audiences skillfully, their writing was more likely to be read and thus they were more capable of acting in their professional contexts. This audience awareness is exhibited

through their use of specific generic conventions, including stylistic choices and an ability—or a willingness—to be more descriptive than was perhaps necessary. As I argue in Chapter 2, each participant's genre knowledge enabled her to act within their individual contexts to craft reader-centered writing. Katy manipulated the generic features of the meeting minutes in order to facilitate the reader's use of the document. For Christine, her understanding of engineering writing as often appealing to a dual audience enabled her to appeal to both academic engineers and engineering managers or practitioners. Emma too called on her developing understanding of the variety of audiences available to her to shape her writing to accomplish her goals. In this section, I analyze the choices these writers made that were influenced by their sense of the readers they appealed to.

Katy

As I analyze in Chapter 2, Katy's writing of the meeting minutes was influenced by her desire to use that document to accomplish several actions. Her primary motivation was reader-centered: she wanted to make sure that not only was she perceived as a competent professional but also that the minutes were actually used by the reader. She used this same approach as she wrote a preliminary engineering report to determine what information to include and how to organize it. Audience considerations were frequently at the heart of her writing, and her choices were based on what the reader might need, want, or expect. Despite the fact that the majority of her readers may only read the executive summary and little else within a report, Katy takes a great deal of care with her writing and is satisfied when the report actually is read and used:

> That's kind of the frustrating part is when people tend to not read them, you know you do a lot of work for a client, they pay you a sizeable sum of money for you to produce, to do research, basically, then to put that into a report, and then they'll read the executive summary and that'll be it, and you'll be like "oh, ok, well…alright." So when a client reads a report, I feel really good about it, like "thanks! Someone actually did something!" (7 Nov. 2013)

More importantly, Katy's audience awareness is influenced by her knowledge of the importance of clearly conveying design choices in writing:

> I think it's important. I think it's very important, and I think it's important because you have to convey, convey thoughts and design ideas in some manner, and you have to do it in obviously a written fashion. So I think it's pretty important, and I think a lot of kids think, "oh I'm going to go into math, I'm going to go into engineering, and I won't have to write ever," which is absolutely incorrect. I think I was able to pick that up a little bit in school, but maybe didn't realize just to the extent, yeah you're going to write reports more than you're going to be doing design work. Because it may just take you a small amount of time to come to a design conclusion, but then you have to put that in writing for, say, a city council or a commission—you have to explain the whole process to them, which might be really easy to you, but you've got to put it in a layman's terms and that can take a very long time if you're starting from scratch. (7 Nov. 2013)

In her field, where state regulations influence the content, amount, and form of the reports, it would be easy to dismiss report writing as meeting mandates rather than as conveying ideas or convincing a reader that the design offered represents the best solution to their problem. Katy's success is connected to her ability to focus on the audience's needs and to use writing as a tool to inform and to persuade.

One feature of report-writing that is influenced by the drive to inform and persuade a reader is how engineering knowledge is conveyed, particularly in the use of sources. As I observed Katy writing, she consulted sources constantly; yet, the final texts included very few citations. When I asked about this tendency, Katy remarked that essentially she only included a citation if she wanted her reader to be able to refer to a particular manual or source. Otherwise, there was no need to cite the information directly or list sources. Unlike academia where writers must include sources to ground their research in past studies and demonstrate how their own work extends that knowledge, professional writing is more concerned with solving the problem the client needs resolved and justifying their solution. In other words, the citations are generally

unimportant for what is considered engineering knowledge, but may be crucial if the writer needs to call attention to where information came from. For example, as Katy wrote, she would frequently move back and forth between the regulations and other sources she was using and writing but rarely cited the information in her report. She commented that she feels the need to educate herself before writing sections—she takes the time to thoroughly read and understand concepts and principles before writing about them so that she can more clearly communicate with her audience.

Christine

As an engineering researcher and a member of academia, Christine was as thoughtful of her audience as Katy. As I analyzed in Chapter 2, Christine's genre awareness enabled her to appeal to a dual audience, especially in her use of visuals in the text; however, her understanding of scientific writing as narrative drives approach to allow her to appeal more effectively to her readers. In *Writing Science*, Joshua Schimel (2012) describes the process of academic writing and publication as *storytelling*: "A paper tells a story about nature and how it works, it builds the story from the data but the data are not the story. The papers that get cited the most and the proposals that get funded are those that tell the most compelling story" (p. 8). As a working scientist with an extensive publication record, Schimel (2012) highlights that good scientific writing is what tells an engaging story to appeal to the reader effectively. Christine's awareness of the audience's desire for a good story influences her approaches as both a writer and a teacher/mentor.

In her own training as an academic, Christine acquired the understanding of the narrative nature of scientific writing as well as a drive to make the writing itself appealing to the reader. One element she uses to tell that story is to pull in actual scenarios:

> I tend to put practical examples, you know, some kind of case study that's rooted in a real example. So I'm not just going to say "imagine there are five barges and that two of them are disrupted and it lasts for two hours and this is what you get." I will say "a windstorm caused a failure of the bridge over the [X] system, it was down 24 hours," like I will pull up that data and use it. I think that's important in putting the context and convince anyone that it could be used for something realistic. (20 Jan. 2015)

In other words, her tendency is to use actual cases to ground her research because it tells a more compelling story. Her research does not use hypothetical situations that might more perfectly fit the point she is trying to make because the real scenario would more realistically demonstrate how the research fits into the problems engineers have actually encountered. Additionally, it is more *convincing*; Christine is conscious that this element of storytelling enables her to be more persuasive and thus more effectively accomplish her goal. When I asked her about her particular process, storytelling was at the forefront of her approach in deciding what she referred to as the "minimal publishable unit" (20 Jan. 2015):

> I'm very systematic in the way that I write, and when I'll put proposals together, I'll get things written by twenty people, and I'll take all of that and put it into an organized story that sells and try to figure out the common themes and what are the common projects that we're going to carve out of this. (20 Jan. 2015)

She reiterated that goal: "Oftentimes I'm going from multiple documents and trying to put it into something that is a single story that someone outside can understand" (20 Jan. 2015). Her understanding of research publications as storytelling is linked to her desire to appeal to her audience effectively.

In line with this understanding of the narrative nature of published articles is Christine's role in educating her graduate students to "mak[e] sure that it's something that other people will find pleasing to read" (23 June 2014). When I asked her what factors influence how she instructs her students, she commented that in addition to concerns such as grammatical correctness and style, "There's actually how to write technical content, so how do you tell a story that someone

can actually understand and appreciate" (20 Jan. 2015). As she trains her students to account for the audience's needs, she is conscious of the neccessity to include the right level of information to tell a complete story:

> So when you're looking at this student's work, you're also looking at it if will anyone outside this project understand what we're trying to say. And sometimes the students are just too close to it that they'll skip over big chunks, and so I'll explain to them that no one could ever recreate what we did because we left out this big step in the middle and so we need to add that in. (23 June 2014).

The element of storytelling is embedded in her approaches to teaching her students to think about their audience as they write. As novice researchers, students often are "too close" to the study or to the methodology to provide a clear sense of what steps they took to construct the methodology. In addition, she also trains her students to be aware of the IMRaD genre itself in order to know what the function of each section is and its connection to telling the overall story:

> What I keep saying to them in the introduction or literature review, can you appreciate why this problem is important? But then in the methodology, it's like someone needs to recreate this on their own. If they wanted to sit down and do this, could they understand? That's sort of the skill in writing, whether or not, you're so close to it, and you just assume that people know how to do steps 3, 5, 8 because you've done them 100 times, but in reality if you don't write down exactly where the data came from and what technique you used and what assumptions you made, no one can recreate that. And they really need to be able to do for the most part. And then with the results, there's usually back and forth, like they want to write down things that are obvious and you want to say you're trying to write down insights that someone who doesn't just look at the table can see, and then we'll write the conclusions kind of at the end, and it's just sort of simple conclusions, then future work to help others who would want to extend this work what they would like to do. (20 Jan. 2015)

Thus, each part of the journal article is presented as appealing to the audience in a specific way and conveying an interesting element of the story the writers are trying to tell. The introduction establishes the importance of the problem, the methodology outlines the steps taken in a way that could be replicated, and the results provide insightful data, and the conclusions encourage the readers to take up the problem themselves. This reader-focused approach is more powerful than

thinking about each section in terms of only the information it needs to convey; instead, it focuses the writer on the audience's needs and their motivations for reading. By keeping her focus on the audience, Christine is able to more powerfully tell the story of her research as well as effectively educate her graduate students on how to be effective research writers. This audience awareness enables her to not only get her research published, but attract readers to that work so that it will be read, cited, and extended, which is a major metric of success for an academic researcher (Schimel, 2012).

Emma

Emma also took her audience into consideration as she drafted her documents. Given her educational level as a sophomore and her lack of professional engineering experience, she theoretically should encounter difficulties in fully conceptualizing her audience (Winsor, 1996). Yet both her writing and her commentary demonstrate that audience is a central concern. For instance, she described her struggle with the presentation she had to give as part of the CGI grant. She had a hard time remembering the information and feeling that she was effective in conveying her points:

> Because at first, I had to learn from another engineer to learn how to talk like this by Kimberly. And she was extremely technical with everything she said. And then she taught me how to do a presentation for the CGIU competition, and it was extremely technical and it was all scientific and all facts and data, and man, I just—I couldn't remember it that well, and every time I told it to people, I would mess it up and they wouldn't understand either, because it was just, it just didn't appeal to them. And on my way up to CGIU, my mom was in the car with me, and I was going through with the oral presentation, and she stopped me and said "why are you using Kimberly's words? There's not going to be that many Kimberlys out there—say it how you would say it to me. When you explain the project to me, I understand it and I like it. But when you use Kimberly-words, I don't care, and I can't keep up with you." And so I learned to speak about my project in a way that's not technical, but in a way that's still the facts and engages with the community. Because that's who we're talking to, the community, not other scientists. (19 Sept. 2014)

This anecdote represents a pivotal point for Emma in her education, where she became more conscious of the importance of focusing on audience. When she was able to recognize that not only was she trying to use words she herself struggled with but also a non-technical audience would be unable to understand, she created something more effective. This understanding would continue to shape her writing as she came to focus on the audience's needs rather than using what she thought was the right kind of language.

This audience awareness was present in the reflective writing Emma had to submit for the CGI grant as well as the reports she wrote for her design class, and it was an element she took into account when considering future writing tasks. In the reflective writing I observed her drafting, Emma commented that she felt she was less creative, partly because her relationship to the audience had changed: "I feel like I already caught them, I already got them excited, and so I'm just telling them what happened now. I didn't have that pressure to make them feel like they were happy to have chosen us, now we have evidence that we actually did this" (16 Dec. 2014). She also demonstrated that she knew the stakes of this writing were particularly lower than, say, the grant that she and her peer spent weeks developing and perfecting. Emma understood how her reader would use the reflection: it would be read once, then possibly consulted again if the group did not complete something they had promised. It was a record of progress, and while it was a necessary part of the grant, it would likely be read once and then filed to never be seen again. This knowledge, however, does not prevent her from trying to craft a thoughtful and well-written response; like Katy and Christine, she realizes that there is value in accomplishing a writing task well.

Writing More than Enough

A consistent feature that all three women shared is that they often write more than is necessary to accomplish their purpose. Despite their awareness that technical writing is concise, they justified their use of description as useful to the audience or even to their later selves. While their tendency to provide more information than their peers calls to mind stereotypes of overly-talkative women (which I examine in the next chapter), their willingness to write more and describe thoroughly is a marker of their audience awareness and allows their writing to be more successful. Given what might be seen as a cult of efficiency in engineering, the tendency to be more descriptive or give more information might be risky, yet each woman was able to justify it because of her concern for what her audience needed. Essentially, they were able to distinguish between efficiency for efficiency's sake versus using the right amount of words to accomplish their purpose. In other words, they did not confuse the value of concision in technical writing with writing the minimum, but were willing to write more than the minimum if it served their purpose while still maintaining the value of efficiency. This distinction is one that potentially sets them apart from other writers because they write not with efficiency as the central concern but with the audience's needs.

For Katy, her focus on her audience often led her to write more than was expected. The joke in the office was that she could not write a short report because she often included more discussion or description than other writers might. Her inclusion of more information was not a misunderstanding about the values of efficiency or concision—as I discuss in Chapter 2, after all, efficiency is a trait that is crucial to her engineering identity—instead, it was details that she felt were useful to her reader. In fact, the president of her firm commented that

> What I've noticed about her writing is that she almost writes like she's writing a
> textbook because it has a textbook type feel. She goes into a lot of detail, a lot of

explanation. Another thing about it she's fast. Usually when you go into that much detail, it takes a long time to generate something on the page, and she's fast at everything she does. And usually it's really good. (18 Feb. 2014)

When I asked if this was well received by her readers, he remarked that while the detail might be a little more than strictly necessary, she is not perceived as "talking down to anybody" (18 Feb. 2014). He also raises audience as the concern, noting that "You could have multiple people reading these reports […]. I don't think it's been ill-received. She fleshes everything out wonderfully" (18 Feb. 2014). It would seem, then, that her willingness to go into detail has the advantage of allowing multiple readers to get something out of a particular report.

Ensuring that her reader has sufficient information provides the motivation to continue giving a high level of detail. In a report that was a preliminary investigation for a city looking for alternatives to their current biosolid disposal methods, Katy found herself going into more technical detail than she had originally planned, saying, "I didn't think the report was going to warrant it. I just thought we were going to look at existing facilities and their capacity for what they're doing. Which honestly is what they'll probably keep doing. But they wanted to be prepared" (29 Oct. 2013). It was the audience, however, that influenced her decision to provide more detail:

> It was probably the point of perspective—I thought these commissioners are going to have no idea what I'm talking about in terms of classification of sludge systems and why you have to have certain treatment types to achieve those classifications, and what you can do with it is restricted—you know if you sell it to people or they come and get it […], say, if they're using compost for their yards, it has to meet certain criteria. And the more I started to think about it, the more I thought I needed some upfront data about why it was important, why we even compost, and it's not like 'oh, we're composting in our backyard.' So here are all these technical requirements and regulatory requirements the EPA has […] And then talking to my other boss, who was there for the presentation that we gave […]. And so I had some charts in here—and this was not given to the commission, this was given to the technical guys—so I had some of these charts in here, and they were like why don't you just put those charts back in the report. I thought, ok. (29 Oct. 2013)

Because she had two audiences—the more technical reader and the wastewater commission reader—she understood that it was useful to delve into the background as a way to ensure that the entire audience understood the regulations and constraints that affected her firm's recommendations in the report.

Christine also commented that one feature characteristic of her own writing is her willingness to go into more detail. Her motivation for this was also audience-based. For example, she described a situation in which she was unable to reconstruct a research methodology from an older report, which presented a barrier to her own research:

> I know how painful it is to really try to look in detail into someone's paper and they're missing key components. And it could be something that happened so long ago that you can't go back. We've tried to recreate, in the healthcare logistics, a report that was from 1996 based on these federal documents. And we have tried, I mean we dedicated years trying to do this, and there was no way, any information they gave you, to try to match up categories to be able to pull it. (20 Jan. 2015)

As a reader, she knows how frustrating it can be to attempt to recreate a study and be unable to do so, especially given the value of replicability in science. When I inquired about what in a coauthored research article might be distinctly *hers*, she pointed to her own tendency to be descriptive and to be structured in her approach to the literature review and methodology:

> It's interesting. Like our work is not that creative so it's not. I don't know, I don't know how easy it would be to distinguish between other people that I think write papers well. It's very important to me that someone can recreate what I'm doing. So like I know—my husband writes a lot of papers and his, he uses the minimum amount of words and it's not that they're not accurate and sufficient, but I'm always, I feel like I'm always like there's something in there that should be in there a little bit. I always try to make sure people—I don't know the answer to that. I don't know if like, I don't if, it's hard for me to answer that. I'm just not as familiar with writing styles. (20 Jan. 2015)

Christine acknowledges that while it is possible to be effective without providing as much description, her desire to make sure her readers have all the needed information drives her to

include more detail than might be necessary, and she is conscious that this tendency may set her writing apart from her peers. By providing more than is necessary, Christine is potentially able to be more successful in appealing to her readers and getting her research published.

Emma also connected her audience awareness to her ability and willingness to explain and go into detail. When I asked how her style might differ from someone else's, she responded: "I go into much more detail than most people do. Other people are much more concise. I use simple words but more description. Other people use more complicated words so they don't have to use description. Like this word will take the place of these four words" (16 Dec. 2014). Her desire to use simpler words was a decision driven by her awareness of audience and her own experience as a reader. She remarked:

> I like going simple because I don't want to have to get a dictionary out when I'm reading a technical paper, you know? I want it to be explained in the paper so I don't have to go research [concepts]. That information is in the reports, so they don't have to go digging for it. Because I've had to do that a couple of times, and that's super annoying. So annoying. (16 Dec. 2014)

In her preferences, Emma reveals that audience is a central concern, which in turn shapes her writing style and other features. She is interested not in using polysyllabic words that many students mistakenly believe are more academic; instead, she prefers to ensure that her reader, no matter who they are, can grasp the concepts easily and efficiently without consulting other sources.

Emma also remarked that in her freshman engineering seminar, she would often receive positive comments on her written assignments, partly because she wrote more content. When I asked if she felt that she was better at explaining, she replied:

> Yeah, I definitely feel that way. And I didn't come from an engineering family background. And so whenever I explain back to my family, because my mother, she's my editor for all my papers, so I always call her and I read her my paper, and so she's the one who gives me feedback, and if she doesn't understand it, then

> I have to go into more detail, and I know I need to add more stuff. Because she's extremely intelligent, but sometimes the engineering, the technical words, they'll bypass. Like the normal everyday person's vocabulary, so they need more explanation. And I feel if you explain it, it shows you know the nitty-gritty details of it, and that's important to show your instructor. Because obviously your instructor understands the process, but by you explaining it, you're not only showing the instructor that you understand it completely but you're also writing it again inside your brain, implanting it in there more firmly, so you're learning it better. (25 Aug. 2014)

In writing for a non-engineering audience, she recognized the necessity of providing more information to enhance their understanding of technical topics. Her awareness of the purpose and audience of school-based writing also influenced the depth of response she provided; writing more than the minimum not only allowed her to learn the information better but to demonstrate her learning more effectively to her professor. Because Emma was willing to write more and go into more detail, her writing was more successful in appealing to its reader, earning her good grades, and enabling her to display her learning.

Tackling New Writing Situations

Audience awareness enabled these women to use their writing to effectively appeal to their readers, and they used their metacognitive awareness of familiar writing to approach new or unfamiliar writing situations or genres. While I did not have the opportunity to observe Christine or discuss more than the academic genres of writing she produced, her ability to discuss her writing so consciously would indicate her ability to write within new genres if needed. In fact, her movement among various research, teaching, and administrative genres indicates her adaptability when encountering new writing situations. Christine recognized the distinctions among these different forms of writing and could adapt her writing to best suit the variety of purposes each genre would serve. Her ability to successfully negotiate these various rhetorical situations would indicate an ability to adapt to any new writing situations that came her way.

Indeed, my conversations and observations of both Katy and Emma demonstrated this adaptability, which is a predictor of success through writing. Bawarshi (2003), for one, argues that genre can serve as a "passport" to provide a way into various disciplinary genres. When students are able to do genre analysis, they learn "to read and negotiate the boundaries of various disciplinary and professional contexts," which means that the first-year writing course "can become the site in which students learn how to access, interrogate, and (re)position themselves as writers within these disciplinary and professional contexts" (p. 155). One of the challenges that novices in the workplace face is how quickly they can acquire and successfully use a new genre (Winsor, 1996), and Katy and Emma both demonstrated their level of genre awareness was sufficient enough to allow them to analyze and perform the new genre.

Katy used her knowledge of not only engineering genres but also the more literary genres to respond to new writing situations that presented themselves. As a side project, Katy has been working toward starting a business making cheese, which has required her to develop various documents required by the health department. She equated these genres to writing engineering reports, importing the technical style familiar to her from her work as a professional engineer. Because she is so confident in her ability to write well, she refused to use the documents that were available, instead rewriting them to suit her desire to craft documents that are well-written as well as effective. Additionally, she has been experimenting with blog writing, which she cast in terms of technical writing:

> I have really mixed feelings about blogs in general. And that's a totally different technical style too because I feel like I need to be interesting but brief while being a little comedic. I don't know, that's kind of what I enjoy reading, I guess if I'm going to read a blog. I want it to be interesting and maybe a little light-hearted. Like I want to feel good when I'm reading it. So there's a lot of pressure in there, as far as anybody in the whole world could read this and what if it really sucks. (7 Nov. 2013)

Katy was aware that blog writing has its own features, and while she still seems to use the lens of technical writing to approach her writing of these blogs, she was also conscious of what a reader will want to see and how she needs to accommodate for the different audience that a blog attracts and her purpose for writing them. She also used her own experience as a reader to shape her approach to this new form of writing. And while the challenges presented by a new genre did spark some anxiety, it did not prevent her from attempting to write:

> I guess with a blog it's a lot of pressure, where I'm like I don't know, is this good blog fodder? I don't know, so maybe whenever I put that out there, I can get some feedback from some people, because I feel like I want to express myself and tell my story, and I feel like my personality is very earnest, so I feel like my writing is a little like that, but then I'm like, no no, I can't be too serious! I need it to be funny or people won't read it! So yeah, I don't know, that's new territory for me.

This anxiety is certainly part of the learning process, but because she possesses a writer identity and is able to understand the demands of the new writing situation, she does not shy away from writing in a new genre.

As a less-experienced writer, Emma constantly encounters genres that may be new to her, and her ability to learn the features of those new forms is a sign both her current and future success in engineering writing. As she informed me, she is willing to talk to her professors; while she too feels anxiety about her writing, she does not let that anxiety prevent her from tackling a new writing situation. Emma's ability to find good mentors (discussed more in Chapter 5), to ask questions, and to keep her audience's needs as a central concern facilitate her response to unfamiliar written genres. Her writing experiences in her courses, her research internships, and her extracurricular activities have exposed her to a wide range of genres and enabled her to analyze a new situation and figure out what the rules are for the writing she must produce. In fact, Emma had never written a technical report prior to her design class, and while there were some struggles as she learned, she was able to understand the requirements and the specific

features of the lab report. I examine her acquisition of the report genre in more detail in Chapter 5; her navigation of the variety of texts, however, indicates not only her ability to adapt to new rhetorical situations, but her metacognitive awareness of the distinctions in forms of writing.

Work Ethic, Writing, and Professional Recognition

Each woman participates in a range of professional activity, and writing is the tangible product of her intellectual labor, thus can be seen as evidence of communicative ability as well as a commitment to quality work. The writing samples I collected and discussed with each participant demonstrated that they were willing to write more than the minimum necessary to accomplish a task, earn a grade, or publish in a journal. Their drive ensured that not only were they successful in accomplishing whatever task necessary, but that they were recognized for their work. Christine pointed out that, especially for academic engineers, writing was the primary form of communication within the larger research community: "The writing is critical. The only way for people outside of this building to know who you are is to publish your work. And that leads to, and that's the foundation of what it is to be successful" (23 June 2014). Writing represents the means by which engineers present or communicate their work to others, thus it can become a vehicle through which an engineer represents her commitment to quality work as well as her professional status.

As I observed her writing and interviewed her, Katy revealed her strong opinions about writing as well as her own work ethic. For instance, while it is standard procedure to borrow relevant passages from past reports or other sources, she frequently revises the language: "I can pull other reports and see what they're like, which usually I think I can improve on, because you can definitely tell that some people are better technical writers than others" (7 Nov. 2013), and she knew that her skills were often stronger than the writers of those past reports, or even her

past self. When I asked how she compares herself to her coworkers, she joked, "I think I'm at the

top of my class, Jenn" (17 Dec 2014). Katy's confidence in her writing is the result of being able

to distinguish stronger writing from weaker writing, and because she knows that she's likely one

of the top writers among her peers, she does not hesitate to criticize others' writing:

> I feel like I always have room for improvement, so I don't want to say I'm 100%,
> there's nothing more to do because that's not true. It's easy for me to say that
> because I don't work with people who I feel are superb writers […]. I get to be a
> big fish in a small pool. I'm sure there are far superior writers, and I can glean
> from those superior writers, but I feel like from who I work with, not so much.
> Because sometimes, I read things that people write, and I'm like *well*. I would
> have done *that* differently. (17 Dec. 2014)

Because she does see her writing identity as a part of her engineering identity, she knows how to

approach writing and how to make it better. Her manager/direct supervisor confirmed that

writing is one of her many strengths as an engineer: "She's very good at technical writing. So

when she gives me something, I know it's going to be a quick review because I'm not going to

have many comments" (26 Feb. 2014).

This drive to produce excellent writing and go above and beyond expectations is directly

linked Katy's strong work ethic. She does nothing by halves, and the thought of making a

mistake was one that she could not even consider:

> I think sometimes—I don't know if this is typical or not—for instance, [some
> people] will put a report together, and it's just good enough. And they won't
> agonize over it, and they'll just get it out, and it'll be whatever it is. But I feel like
> I really internalize things and want to make it squeaky clean and beautiful. And
> I'd hate to do something wrong and be called out or embarrassed because they
> didn't do something great. (17 Dec. 2014)

When I asked why she was willing to go into so much detail, she answered me impatiently:

> I think it's an attention to detail. And I think that's important in engineering
> period because the death is in the damn details is what I'm finding. You can do
> big picture, but if you don't really bring in every tiny thing, then that's just money
> wasted or a lawsuit. Or you don't get what you thought you were going to get. So
> I try to think in those terms a lot of the time. (17 Dec. 2014)

Her work ethic was tied to a personality that simply would not allow her to do the minimum to

get by, and it was caught up in her sense of responsibility to her work, which related to both her

own personality and to gender stereotypes:

> I feel that this is a little bit of a male stereotype, where they tend to divert blame a
> little bit, where they can't internalize it as "I wrote that report or I designed that
> facility, and I fucked it up, and I take full responsibility for that." So a lot of times
> they're "oh, there were these certain circumstances," like making some sort of
> rationalization for it. And sometimes, maybe it's right. Maybe it's they threw you
> in the deep end of the pool and they should have trained you. But I think I would
> be like "oh, it's all my fault!" I've had those moments actually, where I'm "oh!
> I've destroyed everything," and they're like "calm down. It's fine." (17 Dec.
> 2014).

Her strong sense of responsibility is informed by her knowledge that the stakes are high in

writing: one, the report represents a product that a client paid for, and it is also a public

document. Katy also knows that while the firm is technically the one responsible for the report,

her stamp is on the cover, and any mistakes would also reflect badly on her ability. Finally, she

comments that "the highest risk in general is telling them to do something and then it's wrong,

and they spent money and whatever to do it" (17 Dec. 2014). The risks do not hold her back;

instead, they motivate her to always produce writing that is thorough, well-researched, and

complete. She argues that "I feel like that's just conscientiousness, and I feel like men should be

just as capable of that" (17 Dec. 2014).

Also connected Katy's work ethic is her desire to learn more by asking questions. Katy

does not see relying on the expertise of her mentor and the more experienced engineers in her

firm as calling her own ability into question:

> Maybe this is partly my personality and partly gender roles too, the asking of
> questions and trying not to fuck up in the first place where I'd be more likely to
> say 'teach me, tell me,' and not seeing it as a weakness that I don't already know
> these things versus people who maybe don't know to ask the question or feel like
> I exhibit doubt or ask questions, they won't think I'm as smart. There's nothing at
> risk there, they're going to pay you the same. (17 Dec. 2014)

She emphasizes the role of mentorship, and she knows that there was no risk in her pursing

opportunities to learn more and to ask questions. When I asked if there were any negative

consequences to asking for help, she responed:

> No, I find the right person. I work with people who are capable and I work with
> people who aren't capable. So I get a pretty clear idea of who is a good mentor
> and who isn't a good mentor, and who actually knows things and who is full of
> shit. So I just tacked on with finding a mentor who I can ask questions. But that's
> his role, that's what he's supposed to do. But I don't see other engineers talking as
> much with him. Some, some but there's a reason my office is next to his. (17 Dec.
> 2014)

I will examine the potential issues with regard to Katy's fear of making mistakes in the next

chapter, but here I will focus on the positive results of that anxiety: Katy's goal to always do the

best she can has led to success and professional recognition by her firm and by agencies outside

of the firm, including state and professional organizations.

This recognition has taken on many forms. The first is that she is highly regarded by her

coworkers and superiors as being intelligent and capable. Two of her superiors, the company

president and her mentor, both commented that she was one of the best engineers on staff, if not

the best, for both her technical and her writing ability. The company president remarked

> She just has some of the best skills for either technical or writing that I've seen.
> She's probably, definitely one of the most intelligent engineers we've had here, if
> not the most intelligent, in my opinion. Her writing skills are right up with top as
> well. (18 Feb. 2014)

Her mentor noted that "she's smart as a whip," and that she has the ideal combination of skills:

"But you've got to have a combination of the engineering skills, the engineering vernacular, and

the ability to write English. All three of those things, they've got to come together in the

document that you produce that satisfies everybody" (26 Feb. 2014). The company president

remarked on her ability to produce excellent work quickly and efficiently, even without clear

direction:

> She's very efficient. If you give her a task to do, generally she'll do it in about half the time it takes anyone else to do it. And it's good. It's not just thrown together. You wonder how she's done it so fast. She has an ability to research and understand things on her own without someone who has a higher level of experience to direct her. In fact, in many cases, she doesn't have enough direction, and she does the research and comes back and gives a little bit of an education to the person who's in charge. Which is actually what we want, you know? (18 Feb. 2014)

Her coworkers also remarked that she was a skilled writer and provided good models for them to follow in writing their own reports. In all, both her coworkers and her superiors had very little negative to say about her, and they praised her all-around ability. In other words, they do not see her as only good at writing and less skilled at technical work; they recognize that her strengths as an engineer are how she thoroughly understands the technical knowledge and how to communicate that information to other engineers and to their clients.

In addition to the high praise from her superiors and coworkers, Katy has received a number of professional recognitions. Most recently, she was commended by the state for a report for which she was the primary contributor. However, her achievements began at the university where she entered as a highly ranked student, and when she graduated the top of her class and as the number one graduate in the entire College of Engineering. These academic achievements earned her the position she currently holds, and her firm was excited to be able to employ the university's top graduate, allowing her to work part-time as she pursued her master's degree. In her position, she has been recognized specifically for writing: she submitted an essay to the American Society for Civil Engineers, which won the regional award and placed second at the national level. She was also inducted into the "Shovelers," a society that honors wastewater engineers who have made a contribution to her field. She was embarrassed by this award partly because it has a "goofy" element (inductees are "roasted") and partly because engineers are typically much older when they inducted. Katy commented that it "was kind of baffling to me

that I was so young and they inducted me…I was honored. But then I again I'm not certain what the honor means beyond that you're important in this particular branch of our field" (7 Nov. 2014). Her professional recognition demonstrates the value placed on her work and her contribution to the field, and much of that success is a direct result of her ability to communicate her technical expertise through writing.

Christine too has received recognition for her writing, which she pointed to as evidence of her ability as a writer. In addition to her strong publication record and becoming an American Society of Engineering Management Fellow, these awards affect her success because they are a marker of recognition by the larger academic community. Christine commented that "those [awards] are good to get, especially when related to promotion and tenure. Because it's a good way to show not only is there some quantity in writing but also some quality that people have noticed. Those are exciting to get" (23 June 2014). Her recognition is also related to her work ethic and her willingness to work hard and take the time to write. Of the three participants, Christine's available time was the most constrained because of her many teaching, research, and administrative responsibilities, so it is only by managing her time well and setting aside time to write that she is able to maintain her publication productivity.

Unlike professional engineers whose work may be judged from a number of products, academic engineers and researchers are evaluated on the amount of grant money they receive and their publication productivity. Both of these activities are mediated by writing, and both require an ability to write convincingly and effectively. Of course, the researcher also has to generate the content in order to have something to write about, but as Christine pointed out, if a researcher does not publish, then the findings are not communicated with the greater scientific community. In terms of time management, Christine notes that she excels at being able to work efficiently,

and she has a systematic approach to writing that allows her to accomplish tasks despite the many professional and personal demands on her time. As she comments:

> You have to carve it out. It's the easiest thing to build sort of a glut of papers you need to get out because it only really affects your own personal [career]— especially if it's a student who's trying to get papers out from a project that's ended or a student who's graduated, or proposal writing, if you don't submit the proposal it just doesn't go out. (23 June 2014)

Although the proposal and journal article writing is rarely single-authored, Christine is aware that she is often the one producing the bulk of the text because of her role as an adviser, or as the principal investigator, or because of her writing ability. She indicates that "on the proposal side, I do write a lot, from the standpoint of the journal articles and the conference papers, a lot of that is—it is probably extensively rewritten, if you looked at the actual words that exist in the paper at the end" (23 June 2014). Thus, it would be easy to let the papers go out at a lower level or not at all if Christine did not possess a work ethic that ensured that she maintained not only a certain quality of writing but also a high level of productivity. Without this productivity, Christine would never have reached the rank of full professor nor would she have been appointed as a dean nor would she have brought a research center to the university.

Unlike Katy and Christine who have been engaged in professional tasks for several years and have had opportunities to use writing to gain professional recognition, Emma is still in the early part of her education. She has already demonstrated a similar work ethic, however, and she has actively used writing to achieve professional recognition and success. First, her writing has earned her scholarship money both for her education as well as for a study abroad trip to Tanzania. To travel to Tanzania, she applied for a highly competitive scholarship, which required a series of essays, and she was awarded that scholarship. Emma is the first person from the university to be selected for the Tanzania program, where she will be taking courses in wildlife

conservation and conducting research. In addition to her scholarships, Emma has also been actively engaged with her student group, Arkansas Engineers Abroad, which has applied for and received several CGI grants. One of these grants she helped write, and it is the project for which she is the leader and for which she produces the reflective writing. Emma's desire to do social good, to "build sustainable communities" (25 Aug. 2014), motivates her to utilize writing not only to succeed in her academic work, but also to pursue goals in line with her vision of herself as an engineering professional. In other words, she is already thinking beyond school, and writing is a tool that will facilitate her success in those endeavors.

Because they are conscious of their audience, understand the right level of detail to provide, and are able to navigate among both familiar and unfamiliar genres, all three women are able to use writing as a tool to enhance their professional success. The picture presented here is one that is positive—these are highly successful women who understand writing as not an obstacle to the design work or the real work of engineering, but a necessary tool. By understanding writing's place within the field of engineering, Katy, Christine, and Emma do not see it as a barrier but rather as a key to the engineering world. They understand writing is one of their strengths and that this ability has served them well as they produce the professional work required of them.

Their diverse educational experiences, perhaps more typical to women, and certainly characteristic of high achieving engineers, enable them to understand not only the importance of writing to a field like engineering but to enter the profession with a more developed set of skills. Research demonstrates that male students often achieve higher scores in math and science reasoning while female students earn the highest scores in writing and verbal reasoning (Wai, Cacchio, Putallaz, & Makel, 2010), yet this is not a characteristic of gender but of the forces of

social norms acting on these students. Indeed, Jonathan Wai, Megan Cacchio, Martha Putallaz, and Matthew Makel (2010) note that although the research focusing on student success in STEM focuses on mathematics, they should not preclude verbal skills as also being vital to success in STEM careers given that "the ability to read and synthesize scientific papers, write compelling grant applications, and develop one's ideas requires verbal and writing ability" (pp. 413-414). However, just as it would be problematic to argue that men inherently possess greater mathematical and science reasoning skills simply because they are male, we cannot claim that women are better writers because they are female. Instead, socialization pressures and educational experiences come into play. In the context of this study, these three women entered engineering with strong abilities in both areas, which enabled them to succeed with regard to both technical and writing skills. In other words, women entering engineering are more likely to have not only high math and science scores, but also be high achieving in other areas (Metz, 2007).

For Katy, Christine, and Emma, then, their strong backgrounds in math and science along with their metacognitive awareness of the characteristics of effective writing enable their success in engineering. In fact, their writing sets them apart from their colleagues, including the men they work with, in becoming a representation of their skill and their success. Because of the sociocultural factors affecting women's performance in math and science contexts that has no bearing on inherent talent or ability, a woman who wishes to enter engineering but feels hindered by her test scores may select another major. Yet if that same woman understands that writing skills can facilitate her success in engineering, she may be more inclined to consider it as an option, especially if she feels it is a field, like Katy and Emma did and do, where one can do some social good (Metz, 2007). At the same time, this use of writing to open doors to women

and shift the masculinized culture of engineering must be tempered with an understanding of the potentials of writing to inhibit women's success. As I explore in the next chapter, writing is not without its pitfalls for women, especially given the long association of writing with lower forms of labor in engineering. However, despite the potential barriers writing may be part of, the stories shared in this chapter reveal how writing can indeed be used as a powerful tool to gain professional success and recognition.

Chapter 4

Blocking the Pipeline: Gender and Writing as Barriers to Success

One day, when we were about midway through our work together, Katy pulled me aside to tell me a story. When she was on site, one of the contractors began railing against the other woman engineer on the project. "I hate working with women," he remarked, "They're too emotional and irrational." Stunned, she asked him, "Am I emotional? Am I irrational?" While he backed down and said no, she was struck by the fact that none of her coworkers present had spoken up to defend her or to make sure the contractor knew his comments were inappropriate for a professional setting. Later, she informed the company's president of what had happened, demanding action to be taken, but while the contractor was asked to apologize, he was neither reprimanded officially nor did her company affirm its support of her as a woman in the field.

Katy's understanding of how her gender affected her work as an engineer would shift somewhat in the months that I worked with her, possibly because through our conversations she began to recognize as gender discrimination what she previously categorized as personal issues. However, it was more likely coincidental because she experienced several sexist events right before and at the beginning of this study. Along with minor interactions like the one detailed above, Katy was also the victim of sexual harassment when one of her coworkers made advances on her at a professional conference. The effects of this incident made her feel cut off from what she had previously felt was her work family; where she had once felt safe and included, she now felt alienated and endangered. She chronicled how she would have previously been comfortable staying alone after the office shut down to continue working on projects with her office door left open, but now she closed and locked her office door if she stayed past the end of the work day. Furthermore, her company's refusal to act decisively to terminate the individual responsible

frustrated Katy, especially when other individuals were laid off after she filed a report with the company's leadership. The company reprimanded the individual at fault and provided guidelines to prevent him and Katy from being in the same space together, but little further action was taken, nor did the company institute any sexual harassment training or other measures to prevent another occurrence. Although the incident occurred some time ago, its shadow still hung over Katy, affecting her work and her job satisfaction.

Sadly, these incidents are all too common in male-dominated fields. In Katy's case, the men she works with and whom I spoke to respect her and highly value her intelligence and ability, yet the organizational forces and the company's less-than-firm leadership contribute to an atmosphere where she, as the firm's only female engineer, must deal with discrimination both large and small. For instance, as the wastewater treatment plant project began, her first in a lead role, Katy recalled that she had been told to not have a baby because it would be challenging to be a new mother and to run the project, though she doubted that any of the young men (whose wives were having children) had ever been offered the same advice. Previously, she viewed the slow reduction of her role on the wastewater treatment plant project as the desire of one of the firm's principals to be more involved, but as we worked together, her growing awareness of gender dynamics made her question how much her gender played a role. During her participation, she observed as her roles on the project were taken away and her input was sought less and less. She had little leadership over the project at the time of the study, and decisions were made without consulting her, decisions that should involve the lead engineer. Even her writing of the meeting minutes was questioned and taken away until she confronted the firm's leadership and took that role back, finally empowered to write them in the way she decided as most effective.

Unfortunately, Katy's experiences are consistent with the stories many women tell of the gender bias they face, both overt and subtle. While the appalling stories of women's experiences of workplace hostility, threats, and harassment may no longer be as frequent, women in engineering still are affected by attitudes and an institutional culture that creates a less-than-welcoming environment. As Stewart, Malley, and LaVaque-Manty (2007) point out, "the *climate* for [women's] effort is often 'chilly' or not welcoming. That is, women are often treated—by students, colleagues, or staff—as in some way unsuitable for the work, and therefore untrustworthy as authorities, undesirable as colleagues, and not fitting in" (p. 6, emphasis in original). J.K. Yates (2001) points to the subtle discrimination that contributes to this unwelcoming environment, which "result from ignorance rather than malice" (p. 42) and is more difficult to identify and address. In various ways, all three participants were affected by their gender from Christine's drive to demonstrate her ability to maintain productivity while having children before official family leave policies were put into effect to Emma's experience of hostility toward women in her more male-dominated engineering courses.

While one goal of this project is examine the earned rhetorical knowledge these women possessed as engineers that enabled them to write successfully, another question is how writing plays into their treatment. In other words, do attitudes toward writing in engineering affect women's persistence in the field and their ability to succeed? I argue in the previous chapter that writing offers the potential for women to gain access to engineering fields and a path to success, but the picture is not so clear-cut given the hierarchization of engineering labor and writing tasks. After exploring the historical association of women with technical writing as well as the lower status of writing as opposed with "real" engineering work, I examine Katy and Emma's experiences to demonstrate the view of writing as "women's work" within engineering. Finally, I

also look at how writing or being associated with writing tasks offers potential pitfalls or barriers to women striving for success in both academic and professional engineering disciplines.

Writing and the Hierarchization of Engineering Work

Technical writing has emerged as an academic and professional discipline, offering career paths to individuals as well as programs of study within universities. Malone (2011) has explored the formation of technical communication as a distinct discipline, a movement that began in the 1950s and has continued to develop through various waves and stages. The goal of this early "professionalization movement in technical communication" (Malone, 2011, p. 287) was to gain the status of a mature discipline with the benefits and opportunities that come along with such status. In the early history of technical communication, it held a lower place than the fields that employed technical writers, and professionalization (through professional organizations and other measures) was seen as a way to raise their standing (Malone, 2011). As some worked to develop academic programs, technical communication was not always well-received, and there was tension between the academics in English departments and the practitioners working in the field (Malone, 2011). As one such practitioner would note, "In the early days, the 50s, technical writing and the technical writers were without much honor, especially in academic circles" (qtd in Malone, 2011, p. 299). Some of this tension is indicative of the often contentious relationship between English departments and engineering programs where "English teachers saw engineers as soulless technicians, while engineers saw English teachers as dreaming aesthetes, promoting 'refinement and culture' to the exclusion of reality" (Connors, 1982, pp. 331-332). The increasing demand for technical writing by engineering colleges, however, would lead to the development of more courses—often housed within English

programs—to train those engineers to meet the writing demands of the workplace (Connors, 1982).

Women have long been a part of the technical communication field as students, writers, and instructors. Early academic programs to train students in technical communication developed specifically at women's colleges, such as Simmons College in Boston and Margaret Morrison Carnegie College in Pittsburgh (Malone, 2011). The emergence of these courses and degree programs in specifically women's colleges reveals the attitude that women were well suited for technical writing labor as opposed to other kinds of technical work. In fact, Rossiter (1995) argues that in the post-World War II period, the women who had found a place in male-dominated fields were soon marginalized or pushed out entirely as the men returned (as cited in Malone, 2010). Malone (2010) notes that "Those who chose to work were often relegated to service ghettos such as technical libraries (as catalogers, abstracters, and researchers) and publication groups (as technical writers and editors)" (p. 144). Furthermore, this work was of such low status that it rarely merited recognition: "Even though their services were essential to the scientific community, they were seldom rewarded or acknowledged appropriately" (Malone, 2010, p. 144). Katherine Durak (1997/2004) also argues that women's contributions were rendered invisible or overlooked because of particular "cultural blinders" (p. 36) that emphasize men's rather than women's work. These blinders mean that "women's technical achievements are routinely under-reported" (p. 38) because they are seen as the users of technology rather than the makers.

Malone (2010) tells the story of Lucille Pieti, a woman who earned a degree in engineering and was employed by Chrysler, to demonstrate how talented and educated women were often pushed into technical communication rather than be permitted to do engineering

labor. In Pieti's case, she was not hidden or silenced, but used publically as a spectacle, a woman whose beauty seemed at odds with the knowledge of automotive engineering she displayed at Chrysler's car shows (Malone, 2010). Malone (2010) argues that as her fame and visibility grew, "Chrysler not only controlled her speech but also her movements, and the work had little to do with her engineering background" (pp. 169-170). Denied the use of her own voice and pushed into a role that had little to do with engineering, Pieti would resign from Chrysler, marry, and later return to engineering as a technical writer. While she was visible where other women were invisible, Malone (2010) asserts that "visibility can be just as potent as invisibility in subjugated women, even in the 20th century" (p. 175). Her case also reveals the importance of using historical examples to critique "contemporary social conditions that direct and constrain professionals in the workplace and their careers" (Malone, 2010, p. 175). Additionally, these early historical cases reveal the hierarchization and gendered associations of masculine engineering work versus feminine technical communication.

Even as technical writing has gained status as a recognized field, women have been marginalized and their contributions ignored in favor of highlighting male involvement. Malone (2010) indicates that many of the women who were actively involved as leaders and the founders of various technical communication societies "have remained largely invisible in our disciplinary and professional histories" (p. 146). Furthermore, it is possible that women's contributions were deemphasized during the professionalization process:

> Long before World War II, technical writing and editing were niches of women's work within technical and scientific fields. The emergence of the modern field of technical communication in World War II and the postwar years continued this tradition even as male practitioners and academics sought to professionalize the field. Although many women participated in the profession-building activities of the 1950s, professionalization may have necessitated a distancing of women to elevate the field's prestige. These women did not go away, of course, but their presence could be and often was ignored. They bore the yoke of the technical

writer's anonymity and the woman's traditional invisibility in technical and
scientific fields. (Malone, 2010, p. 177).

Malone (2010) pushes against the notion that technical writing only became more "feminized" in
the 1970s and 80s, as women became more prevalent in the field; he points out that it was often a
an area where women were more welcome and is what "may account for women's superior
numbers in the profession today" (p. 177). Essentially, women may have been invisible in the
early development of technical communication as a profession, but they have always been
present and associated with that work.

In engineering, technical writing and what is considered engineering labor have long had
an uneasy relationship. While currently ABET and engineering professional organizations
recognize the need for individuals who can write and communicate effectively, in many ways
writing remains invisible. Winsor (1996) points out that engineering students are always
surprised by how much they have to write when they enter the profession, and Katy's coworkers
also revealed the ways they were unprepared for how much writing engineering work involved.
Her direct supervisor or manager repeatedly noted that had he known how much writing was in
engineering, he might have chosen another field; his motivation for pursuing a career in
engineering was due to his interest in design rather than in writing. Despite the large amount of
writing he produces and his active mentoring of younger professionals in technical writing, he
does not consider himself a writer—his professional identity is bound up in his work as a
designer. Katy herself noted that she was somewhat aware of the writing, so while it did not
surprise her as much, it was still an adjustment.

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Writing as "Women's Work"

</div>

The historical attitudes toward both writing and women would seem to linger in
engineering. Though more subtle, the association of women with writing labor has the potential

to prevent them access to the more recognizable form of labor in engineering. While in the academic setting, writing is the currency that leads to tenure and promotion, professional recognition, and research dollars, in professional contexts, writing is necessary but not recognized as the product of engineering labor. Given the long historical associations of technical writing with lower forms of labor in STEM, being known as a writer in engineering may actually inhibit success in a number of ways. In Katy's firm, a hierarchy determines who does what forms of written labor: the principals (or higher ranking individuals) are responsible for contracts, marketing materials, and reviewing the writing of subordinates. However, the younger, project engineers are primarily responsible for the report writing, which will be reviewed by a principal before it is submitted. These reports are the intellectual representation of the design process, and often firms will be hired to write reports that never go to construction. For example, during this study Katy wrote a preliminary engineering report, in which she researched alternatives and offered solutions to a problem, but the city originally shelved the report for a year and just recently has decided to hire the firm to continue the study. She shared that early in her career, it seemed that she was writing report after report that never went to the design phase and never will.

While this process of is typical of civil engineering work, in this organization, the report writing is clearly cast as somewhat lower-tier labor. For Katy, an association with writing at this level echoes historical hierarchies where women did the writing and men did the building. She shared that because she is recognized as a strong writer, she is often asked to do more report writing than her peers, and many of those projects go nowhere. Additionally, she shared with me an instance where she was asked to write a few chapters for another project's operation and maintenance (O&M) manual, but then the sections were reshuffled and she was required to write

even more sections. She resented this because she had done her part, and she felt burdened with more writing on a project that she was not even the project engineer on. Katy also asserted that writing more than designing means that her design and calculation skills remain less practiced and less developed:

> I feel like I write more than I design, I'm losing those skills. So I don't practice as much design work whenever I'm spending a month writing a report. I mean I get some, to get the information in here, but I feel like I focus a lot of energy at something that's also presentable, and also probably more energy than some people that I know, like peers or people in my office, so that's the other thing that hinders. But again, that's kind of the end game. That is the goal. Or not an end goal to write the report, but to get the thing done. (17 Dec. 2014)

Katy dedicates a lot of her energy to producing a well-written report, but for those reports that are shelved, the labor is not as visible as it would be if those projects went into design phase and were built.

Engineering reports are at least viewed as clearly belonging to someone with an engineering degree and professional licensure. In Katy's case, however, one form of writing that reveals an even more problematic association of writing with women is the meeting minutes. As I analyzed in Chapter 2, Katy actively manipulated the genre to attempt to accomplish action. However, the meeting minutes also represent a site of gendered interaction in the hierarchy of her firm. These meeting minutes were to be produced each month as a summary of the project meeting for the wastewater treatment plant and submitted to the contractor and other participants. It was crucial that they be written and reviewed by an engineer with engineering technical knowledge, yet Bob, the principal who had been actively reducing Katy's role on the project in other ways, seemed to view them as a form of secretarial labor. Katy's writing of the minutes thus became equated with work that the administrative assistant could do. In the context of this project, she talked about the odd relationship between her and the administrative assistant on the

project: Katy is technically that woman's superior, yet Katy does not feel that she has authority to ask her to perform tasks or change how she does her job. In fact, Bob will often ask the administrative assistant to do technical research, which should not be secretarial work. Katy commented, "You don't need to have an administrator do the technical research. I'll tell you. It's a really weird relationship we have." In this context, Bob has in some ways placed Katy at the level of the administrative assistant or has assigned tasks that rightfully belong to the project engineer (Katy) to the administrative assistant. For instance, although Katy changed the writing of the minutes to avoid the transcription process, Bob then had everyone begin to send their edits not to Katy, the writer, but to the administrative assistant for final review. It would seem that Bob believes that these tasks are not engineering work—even if they are—or that Katy is no better than a glorified administrative assistant. Katy herself commented that at times she feels like little more than a secretary and that her work is not valued as appropriate for engineering. Another factor, perhaps, is Katy's unwillingness to cede control to Bob and be complacent under his direction. She does not hesitate to disagree with his decisions and stand up for her own. Meanwhile, the administrative assistant is perhaps more biddable and able to be controlled because as a non-engineer, she would have no ability to offer an informed perspective. These factors and the gender dynamic lead to an unproductive working environment and one where Katy's writing labor is devalued.

Emma's experience also exposed a troubling association between women and writing labor. Her experience writing as a group in her design engineering class revealed a division between technical and written work that mirrored the division of the group by gender. Emma and her group member, Casey, became the ones primarily responsible for the writing that was produced, while the two men in the group were more associated with the measuring and data

analysis. While Emma did not attribute this to a conscious split because of gender, the writing tasks definitely fell to the women:

> I definitely know that Casey and I, we do a lot of the writing together. So I feel like boys more or less stick to, they more or less stuck to gathering the data with the fish tanks, you know, putting the fish tanks together. I mean, Casey and I definitely did the drilling in the tanks and connecting the plumbing and what-not, but when it come [sic] to reports, it was definitely more Casey and I working on it. Andrew did help at the very, he did start helping more after he saw how much Casey edited from his paragraphs. (16 Dec. 2014)

When I asked why it happened, Emma indicated that it was partly due to the fact that she and Casey both felt more comfortable with writing, and that one of the male group members took the initiative to gather the data:

> I feel like it just kind of happened. We never negotiated it, we were just at that point where you just go and check the tank when you get to class, and it just seemed that Nishawn was always checking the tank, like he got there early or something, you know he was always the first one there. I don't think it was mainly because of the gender gap, it was just timing-wise, Casey and I had more time to spend together because she, we had more classes together, so we could discuss this type things, you know—and the boys had separate classes from us, so it was really hard to get on the same time schedule. (16 Dec. 2014)

Consciously or not, this division of labor is troubling in that it promulgates the association of women with the production of text or the communication of the data, while men are the active doers, the ones creating the knowledge and collecting the data.

In fact, Joanna Wolfe and Kara Poe Alexander (2005) found a similar gender division in their work with mixed-gender collaborative writing groups: the male participants took control of the computer elements of the project while the women took over the written component. However, in the end, the men's computer work was seen as more prestigious than the written labor and was much more visible, although the women often worked longer and harder on their written components which were rendered less visible in the final product. Wolfe and Alexander (2005) point out that "In two of the groups we observed, the male computer experts contributed

no substantive writing to the group project. In fact, these two men Brandon (Team 2) and Geoff (Team 7) seemed to perceive computer work as a way to avoid writing" (p. 147). Their conclusions indicate that "some team members tended to overlook or minimize women's written contributions while simultaneously praising the quality of men's writing even though those men had not produced any independent writing for the project" (Wolfe & Alexander, 2005, p. 162). In the end, students did not value the writing as highly as the technical labor, and the men who were "experts" (or claimed that expert status) did not share their computer knowledge with the often-female classmates as collaborative pedagogy might expect (Wolfe & Alexander, 2005).

The split in Emma's group, then, between writing (less prestigious) and technical (more prestigious) forms of labor could have had troubling implications. Furthermore, it's possible that one of the group members, Nishawn, took on the data collection as a way of avoiding more writing tasks because as a multilingual speaker, he was not as confident a writer as the women were.

> But he did a lot of the math calculations for us too. So he did contribute, it was just hard for him to get the writing. And he decided, after that he stuck mainly with introduction and kind of like getting into the paragraph that like introduces the problem, he stuck with that because you can literally read what the problem is in the assignment. So it was easy for him to formulate what an introduction paragraph should be like. (16 Dec. 2014)

He was able to feel that he contributed because he collected the data and did the math calculations, acts that are more closely associated with typical engineering labor rather than report writing. Andrew too expressed a lack of confidence, and given the time constraints, seemed happy to allow the women to take over the writing tasks so that it was completed effectively. Emma pointed out the writing that they were given by the male group members was not sufficient, so they had to do a lot of work together to get the report into an acceptable form:

> When each person came to the table, it wasn't done or it was really poorly done, like they didn't pre-edit it before they gave it to us, and so, um, I'm a person who believes wholeheartedly in editing, I don't believe you can write something and it's going to be perfect, you need to edit it. And so things didn't make sense, there wasn't even complete sentences, like they wrote down their thoughts as though they were brainstorming, like that's all they gave us was brainstorming, you know.

In the end, Emma did not seem upset that they had to do the bulk of the writing because it was clear that the men did actively contribute in other ways. The division of labor, however, between technical and written is one that may serve to extend the idea that writing is feminine labor, women are simply better at writing then men, and men should be the ones doing the more technical work of building and calculating. In the end, the work that is rewarded (especially in professional settings) is not necessarily the writing—it is the calculation and the data gathering. If women are denied access to that kind of learning in engineering lab classrooms, it would have implications for their future success. They could accept their relegation to less prestigious written tasks because it matches their educational experience, and they have been socialized to accept these divisions without realizing the negative ramifications of being denied access to the forms of knowledge creation that building and calculation represent.

Description and "Chatty" Women

In Chapter 3, I argued that all three women were able to understand how writing more can be useful to appeal to a reader and more successfully accomplish their purpose. This trait revealed their ability to know when it was essential to say more on a particular topic and was rooted in their considerations of the audience's needs. Yet for a woman, going into more detail runs the risk of being seen as verbose and as not valuing the core principle of efficiency in technical writing. When paired with associations of women as "chatty" (or as not capable of being silent) and with men as being terse, their tendency to describe more raises issues of how

their gender may affect a reader's reception of their work. Katy's joke that she and her coworkers agreed that she cannot write a short report brings this issue to light. For instance, in our discussion, her mentor and manager commented, "[Katy] is going to have to write a facility plan for [Woodsville] […] I hope she's short and to the point and not verbose, if you know what I mean" (26 Feb. 2014). While he certainly praised her ability to write clearly and write well, his comment raises concerns that she would write more than might be acceptable, even if she has legitimate reasons for doing so.

Katy emphasized that she always had good reasons for including more detail. These reasons were related to the fact that a client was paying for her to do research to support recommendations, and that those details made sure the client was getting what they paid for. She equated writers who did not provide as much detail as doing *just enough* to get by: these writers were producing acceptable but not stellar work. Christine's attitude toward her article writing was similar. Her goal was to write descriptively enough that it would help future researchers, rather than focus on the push to get out yet another article. This tendency to produce quality writing rather than quantity of articles has been offered as one explanation to account for the gender disparity in academic publication rates (Wilson, 2012). Yet the implication that Katy, and possibly Christine, were once again breaking some sort of engineering norm by providing more description reveals some of the troubling gender associations with women with talking more and with an inability to be concise—messages that would underscore the notion that women are simply not well suited for work in engineering because they struggle to speak the language.

Emma too had good reasons for providing more description, but she also seemed aware that her tendency to go into more detail was not typical for engineering. She acknowledged that she struggled to be concise, yet she also understood the value of sacrificing concision to be more

descriptive if it benefits the audience. However, her struggle to be concise is something she returned to again and again in our conversations. She explained, "Because I have such a hard time making my statements concise and explaining in detail what exactly is going on in my head in that moment, you know? So I don't want it to be like a huge confused mess" (16 Dec. 2014). Because she's in the process of learning, Emma's statements are indicative of a student actively acquiring a new form of discourse; however, they also reveal an unease with what might be more stereotypically feminine forms of discourse—going into more detail—when compared to the value of efficiency and concision in engineering, which is often equated with more stereotypically masculine ways of speaking. For Emma, if this distinction is cast in terms of gender, or if she internalizes the idea of concise writing as antithetical to her "natural" ways of speaking and writing, it might be seen as a sign that she may not fit in engineering.

Gendered Perceptions of Communication

In addition to being perceived as more descriptive—potentially verbose—Katy was referred to as *blunt* by several of her coworkers and as having some difficulties communicating with contractors. While they were careful to note that these traits were not necessarily problematic and that Katy was generally a highly skilled engineer, the gendered implications of these particular criticisms are worth teasing out. The first is the fact that her mentor raised the possibility that she occasionally had trouble communicating with contractors. As Katy herself notes, as a civil engineer, with active projects being built, she interacts with primarily male contractors who are often hostile to the presence of women. The anecdote that opened the chapter occurred between her and a male contractor, and Katy points out the issue: "The story you've heard me tell about the guy, this specifically in construction engineering which touches a

lot of engineers, is working in the field with jackasses who are sexist. That's really difficult" (17

Dec. 2014). As she continues,

> Being told that women are hard to work with in construction because we are
> emotional is really demeaning. So I obviously experienced that totally different
> than, that comment would never have been made if it was just a man to a man, a
> man to another man. Even though the comment wasn't 100% directed at me, it
> was obviously directed in some fashion at me. So yeah, just little things like that,
> is just insulting. (17 Dec. 2014)

As a woman working in a profession not only dominated by men, but within a culture that is

highly masculine and entails working with other male-dominated fields, such as construction,

Katy is aware that her gender might create some problems. Her mentor seemed to pick up on

those difficulties, though he did not necessarily blame the contractor's attitude toward women as

the source of any potential difficulty. When I asked what area she may be less strong in, he

replied:

> I haven't encountered that area yet, though I will have to say, probably learning to
> communicate with contractors. That's her least strong field, and I feel like she's
> real good at that. And that's something you've just got to learn because
> contractors are a different breed. And the problem isn't' that you can't
> communicate with them. The problem is that you've got to learn, you don't
> always get the truth out of contractors. […] Good contractors do, and you can
> communicate with them. But some of them are just hard to communicate with. Or
> they put, I don't know what it is, but engineers and contractors can get at odds
> with each other. It used to be more that way. And every contractor is different. (26
> Feb. 2014)

 As he revealed, tensions between contractors and engineers also exist because of different

professional approaches and obligations, so the difficulties in communication are also

attributable to a cultural conflict that affects all engineers, not just the women. However, it is

difficult to ignore Katy's gendered interactions with contractors and individuals like them or the

experiences of other women engineers venturing into a domain that is often actively or subtly

hostile to women (Yates, 2001).

The other criticism of Katy's communication style is what two of her coworkers called her tendency to be *blunt*. The president of the company made sure that I did not think he was saying she was necessarily blunt in a way that alienated clients or came off as "angry:"

> In some cases, she can be a little blunt. She has never been blunt in a manner that would cause offense to our clients, but she will definitely tell you what she thinks. And this is not a bad, I'm not—she is a very straight forward person when it comes to conveying her opinion and technical aspects of any job, and she makes sure the client and anyone else knows exactly what they need to know. It's refreshing, in any case to many people. The only drawback is that she can be a little blunt. (18 Feb. 2014)

He tried to couch it as simply a less-positive attribute, yet the fact that two separate individuals both made note of this particular characteristic is telling. Her coworker noted that sometimes she had a sense of her own rightness and would refuse to let things go, also referring to the way she communicated as "blunt" (7 Mar. 2014). One reason this word is problematic is the double-meaning behind it: it is not a characteristic typical of the ways women communicate—stereotypically, women are not blunt; they soften their criticisms and often couch their comments in more positive terms (Wolfe & Powell, 2009). Katy, in her bluntness, is conforming to speech patterns more typical of engineering culture, yet less typical of women. Because she is so direct and blunt, she risks censure from those she talks to, and her coworkers find her directness to be potentially problematic, where it is less likely that they would criticize a male coworker—someone who they know is highly intelligent and often sees things no one else does—if he were more direct or blunt in his communication. And Katy does often come to conclusions that are well-reasoned, and she finds problems that others miss; if she were not so direct or blunt, it is possible that her message would get lost.

In this case, she is in a double-bind, where if she were less direct, her voice would be silenced, yet she risks censure for being so direct in her communication. Joanna Wolfe and

Elizabeth Powell (2009) examines the effects of gendered perceptions of communication in engineering teams, finding that speech acts that were more typically feminine were punished by male participants. Their concern is with the effect of group work in engineering settings on women and how communication patterns factor into collaborative interactions (Wolfe & Powell, 2009). One of their findings demonstrated that engineering men perceive female-typical speech as weaker or as expressing insecurity. For example, women are more likely to phrase criticism using an "I-statement," yet "engineering men evaluated such face-saving moves negatively in comparison to their peers. Engineering men were more likely than others to see the speaker in this scenario as insecure" (Wolfe & Powell, 2009, p. 10). In other words, if Katy were less direct with her speech, she would actually be viewed as less competent and potentially punished. In this case, she is so capable that her so-called "bluntness" is raised only as a minor issue. The point, however, is that she seems to speak in both engineering-typical and male-typical ways, which she must in order to be seen as fully capable and as a member of her discourse community, although she is also criticized for it.

For Emma, gendered perceptions of communicative practices took the form of her unease with her own feelings, a discomfort she attributed to the ways that engineering as a field punishes women who are overly emotional. As part of her study abroad experience, she has been asked to write a blog, a genre that was new to her and one she expressed some anxiety about. The source of her anxiety was that she knew that she should do more than simply record what happened to her. She understood that the genre of the blog post needed

> to be much more inspirational writing. And it's going to be like a diary in a sense because you're going to explain how this experience changed you or what you felt. I guess do more *feelings*. I think that's going to be the basis of the writing, is that you write your feelings out. (16 Dec. 2014)

As she conveyed these ideas, each time she said the word *feelings*, it was enunciated strangely, almost with a wince. So I remarked, "You're staying 'feelings in a really weird way. What's making you uncomfortable about talking about your feelings and how might that be connected to how you're learning to write in other areas?" Emma's reply pinpointed the trouble with being a woman in engineering: often, the culture requires you to deny a part of yourself.

> I think it's just funny, you know, when they tell you, you need to write your experience and get all your feelings out so you never forget it and stuff. And for me, feelings have never been—the quality desired by a female scientist or engineer especially. You need to be, like, like—So when I get upset, I start to cry. It doesn't matter if I'm sad or if I'm angry. If I'm upset, that's my initial response is to cry because that's how I release that tension and that stress. And I hate that. I hate it so much. Because I was in the middle of Statics, trying to fight to get a freakin' A in the class, and he was telling me that I didn't work hard enough, and I walk away and I get tears in my eyes, and I'm like "oh crap, it's coming." And people were looking at me because it's mainly a male-dominated world, it's a very competitive classroom environment. It's really embarrassing to show emotions and to show you care for something like that. And it wasn't the fact that I was really upset I didn't get an A, it was the humiliation because, you know, I'm a girl and I cry. I get emotional. And I hate getting blamed for your emotions because you're a girl. It's like "no, I have emotions because I'm a human being." (16 Dec. 2014)

Her final response—"I have emotions because I'm a human being"—reveals the dangers of writing in certain ways within an overtly masculine engineering culture. Emma understands that the masculine world that she has entered will punish her for feminized ways of writing and acting, and it has affected not only her ability to even think about writing out her feelings for an audience outside of her diary or her close family, but also to even feel capable of being allowed to experience her own emotional responses without being judged.

Writing as a Potential Barrier

For all the success these three women have attained through writing, technical communication also represents a potential barrier to success. As I have examined so far, being perceived as "verbose" in writing, and displaying stereotypically female patterns of speech—or

rejecting those patterns—can lead to criticism or negative reception by other members of the

engineering community. Emma and Katy have both been affected by the perceptions of their

speaking or writing in engineering simply because of their presence as women, and Emma

demonstrated how she feels the need to cut off part of her own identity, her emotions, in order to

be taken seriously in engineering. While Christine seems to have, for the most part, avoided any

inhibition to her career due to a combination of hard work, supportive faculty and department

heads, and wise career choices, our conversation revealed that many pitfalls exist for female

academic engineers as well.

The first pitfall that so many professional women face is the struggle to balance work and

family life. Christine has four children, and she points to a combination of support, hard work,

and ideal circumstances as to why her family life did not interfere with her earning tenure and

being promoted to full professor.

> So when I started here in 2000, I'm not sure, no one seemed to remember if there
> was another female faculty member in engineering who had a baby while they
> were in a tenure, tenure-track position. So I went to benefits, and they said there
> were no policies, so I went back and said this is what I would like to do, and my
> department head was like "ok." So I think there was a little of, we definitely have
> done a better job now, things are formalized and the provost has a faculty
> maternity/paternity policy. So in some ways, I felt like I was forging some new
> ground. (26 Jan. 2015)

In her case, because she did have a supportive department head and partner, she was able to take

the leave she needed and manage her tenure case successfully without even extending her clock.

However, she acknowledges that because she was always successful, she was never in a place

where anyone could have reasonably questioned her success:

> I've been sort of traditionally successful. So that has helped me. I've never been
> in a situation where I wasn't being successful, so that my gender gave me a leg up
> or not. If there were metrics to achieve, I have achieved them. So whatever
> promotions and such came, I worked very hard that my gender was a non-issue. I
> had met all of the hurdles that I had needed to. It would have been very hard to

make a case against my success. Because you do probably feel a little bit in my position like you have something to prove. To show that you can have four kids if you choose and still be successful in a traditional faculty position. (26 Jan. 2015)

The pitfall her comments demonstrate is that as a woman, she was under the pressure to prove that she could have a family and achieve traditional success. And while it certainly worked for her, many women would struggle to accomplish what Christine has. If she were in a less supportive environment or if other factors had worked against her, Christine might have not accomplished her goals, even if she were working as hard (or harder) than her male counterparts.

What is important to recognize in Christine's situation is that she had support from departmental leadership and from the university, and she had a supportive partner, and, as she pointed out, her children were healthy.

> Female faculty are somewhat rare in engineering that they're just desperate to get them in and keep them. As long as there's someone who's clued into this and supportive, and I think at this point none of us are going to hire a department head who's not going to clearly show or indicate, that's going to be something we look for in an interview, that's going to be something we ask references, and at the dean's level the same thing would be true. So at this point I think we've reached an age where at least we are going to put someone in these key positions who would be setting policy or be setting up discussions that are well beyond assuming 'oh they're having a baby, they're not going to be productive.' Because with their experience, at this point they know people like me and others that are clearly able to do both, and while it may more difficult for us at home, it's not relevant to these people. And there's so few of us, they're trying desperately—it's just so expensive to hire and train faculty and so if you can get them to come here, then you want them to be successful. So they're very supportive in trying to implement in FMLA and stop the tenure clock if you need to, and our provost here has sort of formalized that, but our previous dean started to do that formally himself. Then you don't have to say to yourself, if I stop the tenure clock is that bad or how will that be perceived. I'll tell you, I went up for tenure early. My mind was that I'm not asking for any special. Which wasn't necessarily the best thing to do because I didn't forge any new ground for anybody else. But since I was one of the few who was experiencing it first, my view was—and some of it has to do with luck. You work in an area that is of interest and there happens to be money and you're able to fund students and do the work. I think looking back I do feel a little bit like I didn't pioneer, but things weren't as formal as they are now. Now, if our faculty are having a baby, they come and they say what's the policy, we say we file FMLA and it automatically stops your clock for a year, and if you

> don't need it don't take it, but it's already done and you can go up early if you want to […] It's a given now. (26 Jan. 2015)

I quote Christine at length here because I want to show how she is conscious that her own case is unique. She is aware that some might point to her ability to balance family and work and apply that to all women to show that it could be done. But she notes her own good circumstances, and the fact that the people surrounding her were supportive of her decisions in ways that facilitated her success. So while it is true that everyone in engineering must work hard, it is also important to acknowledge that without a productive environment, even Christine may have struggled to accomplish what she has.

Christine also pointed to her ability to separate her personal and professional domains. While many women might struggle to keep work and home separate because of the various social factors that make that separation difficult, Christine comments that she is able to compartmentalize:

> I probably don't work less than my peers who had no kids or who had a spouse at home who that was their primary job. I think if you work as hard as those people do, then there is a non-issue. If you're trying to do what you need to do and work less, than probably tough. And for some people, it's hard to compartmentalize. I've worked for women who have had a really hard time, when they were at work, they were worrying about what was at home, and when they're at home, they're worrying about work. […] I'm pretty good. Once I set foot in this office, unless I get called by daycare, I don't even think about them until I have to get them. And then when I'm at home, I'm very careful to be like I'm at home when they're awake I'm with them, and as soon as they go to bed, I revert back. But that requires your child to be at a very good daycare or school or in a good environment where you're comfortable. So it's very easy for me to direct where I am. You have to be willing to, I don't think you can work less. I'm very efficient in terms of what I need to do, if I'm here, I'm trying to work. I'm not hanging around talking about the [the football team]. I just have to be really careful. I don't have hobbies—I don't sit down outside of work very often. I'm doing something at the house, or I'm—it is a very different, I don't think I could knit 20 hours a week or hike 20 hours a week and still do these two other things. Because they are two full-time jobs that you're trying to get in. So I just try to make sure if they said I had to publish 1-2 papers a year, I just made sure I did 2 or more. I just

tried to make sure that there wasn't even a question. I've been lucky, my kids are healthy, and it's been easy to rely on the system. (26 Jan. 2015)

There are several elements Christine points to: one, she believes that if a researcher simply works hard, she will be successful because that has been the case for Christine. She also notes, however, that she focuses her time on her job and on her family, and she does not attempt to spend her time elsewhere, a trap many women might fall into. Additionally, Christine stresses that when she comes to work, she does not get involved in her coworkers personal lives or stand around chatting: she is there to work, and she does so. Unfortunately, for a woman, this focus might be read as "coldness" or other negative factors rather than drive or ambition and may create other tensions that affect productivity.

The other pitfall that Christine shared is that because women are so underrepresented in engineering, they are more likely to be asked to give up their time for potential "time sucks" in the form of service and other non-additive obligations. When I asked her if women were more prone to taking on a heavy service load, she remarked:

> I think they're more prone to being identified because I think what happens is every committee […] they want to show a diverse representation. So if you're the only woman in the department, you're always going to be asked to sit on there, and then even at the college-level, depending on what you're doing, there were very few of us, one of us was always asked to be on this committee or that committee. Otherwise, it's just all non-diverse personalities. And we all know everyone's a little bit different, but they aren't as diverse, they haven't had the same experiences. And we still suffer because we have a huge lack of ethnic diversity too. So that's something we're still working on. If and when we're ever successful in hiring an African-American faculty member, she'll probably be invited to be on 400 committees. (26 Jan. 2015)

With this awareness, Christine knows that she has to select her service obligations carefully. She seeks out opportunities that are not only value-adding, but are not so time consuming that they distract from her research and teaching responsibilities:

> So you just really have to be careful to say, is this a committee I'm really interested in? is this a committee I think could make a difference? Or in reality could someone do this just as well as I can. […] I do think you get asked to do more things, any person in an underrepresented group would be asked, and you just have to kind of seek counsel and ask advise. We have faculty mentors […], but I had been asked, I mentored two female faculty not in my own department because they had reached out to me or their department heads reached out to me. And then there's just a lot of committees that just take a lot of time and don't really change anything and then there are committees that don't take that much time but have the potential to change things, so you just have to be able to get advice from someone from what kind of committees those are until you can learn to tell yourself. (26 Jan. 2015)

In other words, Christine has learned the value of being to say "no" when asked to participate on a committee that may take a lot of time without having much impact. She has also learned to remove herself from service obligations that begin taking more of her time. Christine actively resists the pitfalls that many women, who are socialized to feel obligated to do more of the helping labor that often goes unrecognized (Grant & Sandberg, 2015 Feb. 8), encounter. She is strategic with her commitments, knows when to say "no," and knows when to remove herself from obligations that are consuming too much of her time.

These pitfalls are specific to women in academic engineering, but many of the issues reach more broadly to women in the profession. Family issues are often cited as a factor as a barrier to women's success, and Katy herself had been told to not have a baby while working on a major project. In terms of communication and writing, these factors lead either to reduced productivity or to a perception of less competence. However, by being good about not bringing her personal life into the professional setting, Christine also exposes herself to being criticized for not being personable. In other words, she may receive criticism for not being feminine enough, representing another double-bind that women in professional settings may face. Additionally, we must recognize that her case may not be the norm: just because Christine been successful in engineering does not mean that all women would be able to avoid the situations

Christine did. In other words, it may not always be possible to be traditionally successful if other factors come into play, and the culture still must continue changing for women to given equal opportunities to accomplish both their personal and professional goals in a supportive environment.

I argue that writing may represent an entry point for women wishing to pursue engineering fields. In this chapter, however, I demonstrate that success through writing is not without its own dangers for engineering women: each of these women experienced—or had the potential to experience—discrimination, alienation, or marginalization as a result of their writing or the perception that they spoke and wrote in distinctly feminine ways. These dangers lurk everywhere for women engineers, but by exposing the risks associated with writing, as Christine's case reveals, women may be more able to use writing to facilitate their success and avoid the potential barriers it may cause. Engineers must write, and successful engineers must be successful communicators with each other, with clients, and with a broader public. Katy, Emma, and Christine's experiences are indicative of the ways a masculine engineering culture may work against them, yet by exposing those stereotypes and attitudes, we can begin to work toward educating and changing the culture and institutions that would continue to perpetrate these status quos. Ultimately, composition researchers and technical communication teachers must keep in mind that writing is not a value-free institution, and that even though great potential for advancement and success for women exists, technical communication is within the larger cultural matrix of engineering and is subject to the same biases and problems.

Chapter 5

Genre Awareness, Mentorship, and Reflection: Paths to Writing Success

"So I noticed before my participation, I was really nervous, like really nervous," Emma remarked when I asked her how her involvement in this study had affected her. "But now I realize that writing has a purpose and showing your flaws is showing who you are too" (16 Dec. 2014). She highlighted her new awareness about the writing process as part of her quest for more knowledge: "I've become more aware of it as I'm writing, where I'm like 'oh this is why I wrote…oh that's kind of cool'" (16 Dec. 2014). Her participation also seemed to ease some of her anxiety because her growing awareness helped her understand writing (and learning to write) as a process:

> It's kind of like taking a test, you know how when you think about taking a test, you always get that nervousness, and then you think I can't remember enough, but then the more you take it, the more you take a pre-test, the more prepared for the material. It's kind of like with writing. At first you're like a newbie and not really sure how you're supposed to say things, you get really nervous, but then after a while it's just second nature to you, and you're like "oh no big deal. I'm going to write out this 11 page report." (16 Dec. 2014)

Emma's comments initially surprised me. Our interaction had been fairly informal; I had neither critiqued her writing nor helped her improve it, and our conversations often just went toward what we each found interesting about literate practices, especially writing experiences. When I later listened to the interview recordings, however, I noticed my tendency to offer explanations as though she were my student or mentee. After all, I enjoy talking about writing, and she was eager to learn more and asked me questions. I did not set out to teach her about writing, yet that seems to be what happened, at least informally. Those conversations would leave an impression on her, and they would become yet another element of her continuing writing education—and part of my own development as a writing teacher.

In the preceding chapters, I examine the ways writing is part of a professional, engineering identity and how writing functions to both potentially enhance and inhibit success. The goal of this chapter is to turn toward what these findings mean for the ways student writers and novices—both male and female—learn to take on the writing demands of their discourse communities. In other words, how can these findings about the role of writing in identity formation and professional success inform the ways we educate writers, particularly in STEM and especially in engineering? The stories these women tell point to three major factors that affected their ability to write well: genre awareness through exposure to a variety of textual forms, mentorship and role models, and opportunities to explicitly examine writing practices. Taken together, these three factors would appear to enable all three women to approach writing metacognitively, an ability linked with writing success. After examining these factors, I turn toward the challenge educators face when attempting to make writing situations authentic or attempting to make school-based tasks mimic professional ones. While replicating the professional situations engineering writers will face after graduation is nearly impossible, course-based writing should not necessarily be dismissed as lacking authenticity but instead recognized for potentially facilitating the acquisition of a writer identity that can extend to the workplace.

Genre Awareness

Recent scholarship in composition studies has moved toward approaching writing, specifically the teaching of writing, as its own discipline, distinct from the English departments with a focus on literary studies that have so long housed composition courses. Many writing programs have embraced the development of first-year composition (FYC) into an introduction to writing studies, in part initiated by Doug Downs and Elizabeth Wardle (2007) with their writing-about-writing approach. Downs and Wardle (2007) argue that just as other disciplines

have an introductory class, FYC should serve as an introduction to an academic discipline, in this case writing.[6] What this means, then, is a greater emphasis on examining discourse communities and genre to encourage metacognitive awareness as students proceed through their university education. Genre scholars such as Bawarshi (2003) have written at length about the use of genre in the composition classroom. He argues that writing courses that embrace the use of genre can ask students to explore texts as a way to teach them not only how to write in one context (the classroom) but also enable them to learn how to analyze discourse wherever they might encounter it (Bawarshi, 2003). While separate from writing-about-writing pedagogies, composition courses informed by genre theory have similar goals with regard to teaching students to think about writing as situated, as specific to a specific community, and as affected by the conjunction of community, writer, reader, and goals.

Underlying these approaches is the sense that genre itself can equip writers to enter unfamiliar settings and analyze what they need to do to write appropriately for that specific context. By exposing writers to the theories developed in rhetorical genre studies, composition instructors aim to provide writers the tools to analyze generic conventions and produce those genres. One component of this education is exposing these students to a wide range of genres and exploring the interconnections between audience, purpose, and exigence and the ways genres respond to those factors in textual form. As I examined in Chapter 3, these women's writing success could be attributed to their ability to appeal to a specific audience (a feature of overall genre awareness), and audience awareness enables them to accomplish their goals and get their writing read and used. In other words, if a student understands that genres are products of

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[6] In fact, this move is also mirrored in the trend for writing programs to separate from English departments that frequently house FYC and into their own "Writing Studies" departments. This move may also be seen as a way to legitimize FYC not as a "service" course, but as a valuable introduction to a clearly demarcated discipline in its own right. Regardless of the debate of where FYC belongs, the trend seems to be toward elevating its status within universities through the "writing about writing" approach.

specific social factors, built to meet the demands of the context and their readers, they will be aware of how their writing must respond to the context they find themselves writing in and what the acceptable forms of communication are.

If genre awareness has the potential to enable writers to modify their discourse to respond to varying situations, then skilled writers will demonstrate not only that they understand how different contexts give rise to different genres, but that they will also be sensitive to the demands of the audience and the constraints on communication enforced by that discourse community. Katy, Christine, and Emma all demonstrated their ability to read rhetorical situations and select appropriate genres to respond to those situations. As discussed in Chapter 2, Katy's keen awareness of the genre of the meeting minutes enabled her to use her writing to improve the ways she communicated with her audience, and Christine was able to use the research article genre to appeal to both academic researchers and engineering managers. Likewise, Emma's immersion into technical report writing in her design class, while painful, also showed her awareness of the distinctions between various genres, which enabled her to successfully acquire an unfamiliar genre. What seemed to trigger this genre awareness was not only an understanding of a particular genre's function in each woman's social context but also their exposure to a wide range of genres. Each woman shared their educational experiences, emphasizing the English classes they took, the different kinds of writing they did, and the large amount of reading they did. Whether directly or indirectly, these experiences affected how Katy, Christine, and Emma wrote for engineering.

Katy

From slam poetry to engineering reports to blogs, Katy's writing experiences encompassed a broad range of genres, and she explicitly connected new writing situations she

encountered to her deep knowledge of engineering genres. In fact, Katy's work required her to write in a range of genres from more formal reports and manuals to the meeting minutes, submittals, and other managerial documents to less formal communications such as emails. Each genre had specific features that she had to attend to in order to meet her readers' needs and accomplish each text's given purpose. Katy's ability to navigate among these various genres was one reason her writing was recognized formally and informally as successful, and she attributed her facility with writing to her past writing experiences and her reading.

Past literacy experiences exposed Katy to a range of genres contributing to the metalinguistic awareness she would apply both within her own writing as well as her reading of both fiction and nonfiction texts:

> I think if you're paying attention to good writing that you're reading that can transfer to your writing, and really that's the technical writing at work if you're reading a report and you're paying attention to the formatting of it then you can essentially mimic that in your own writing. Yeah, it's just a matter of paying attention. I feel the same way […] if you're reading, you're picking up different vocabulary or good grammar and punctuation from a good novel—I feel that you have to be picking some of that up through osmosis that can translate to all different kinds of writing, some of which I know rules may or may not apply in different forms of writing and types of writing so it may not be appropriate necessarily for technical writing. And it kind of blows my mind, and I've made this comment before, it kind of blows my mind a little bit, and I don't mean to be judgey-judgey, but for people who read a lot who are just terrible writers, awful spellers, don't understand punctuation—not to say I'm perfect at all either, because I think you can read, you can get into a story not so much the words the printed words on the page, but I think certain types of reading can certainly help, like if you read magazines all day, I'm not sure how helpful that is for technical writing but maybe. (7 Nov. 2013)

Katy's comments here reveal how conscious she is of genre features of good writing, and it is that awareness that allows her to read examples and understand what is worthwhile to mimic. Her genre awareness also allows her to understand the challenges of unfamiliar genres that she

plans to write in, such as blogs. As she thinks about how to approach blogging, she has read

various blogs and understands the challenges of that type of writing:

> I have really mixed feelings about blogs in general. And that's a totally different technical style too because I feel like I need to be interesting but brief while being a little comedic. I don't know, that's kind of what I enjoy reading, I guess if I'm going to read a blog. I want it to be interesting and maybe a little light-hearted. Like I want to feel good when I'm reading it. So there's a lot of pressure in there, as far as anybody in the whole world could read this and what if it really sucks. (7 Nov. 2013)

Interestingly, Katy describes blogs as "technical," though this may be the frame that she is most

familiar with, thus the perspective she brings to new writing situations. Overall, Katy

demonstrates an awareness of genre that facilitates her writing in the diverse engineering

documents she must produce as well as her ability to learn new forms outside of the workplace.

Christine

Other than her clear mastery of the genres necessary to successfully complete her goals as

an academic researcher and administrator, Christine's genre awareness emerged as she

considered the ways her discipline and my discipline differed. This distinction was initially a

source of some anxiety for her as she considered how to answer my questions about her skills

and identity as a writer, which she couched in terms of how she was skilled *for an engineer*.

When Christine finally answered my questions about her identity as a writer, she acknowledged

that because she's published, she is more likely to consider herself a writer, though initially she

rejected even that identification:

> It's interesting because if someone asked me "are you a writer," I wouldn't say that necessarily. If someone said "are you published," I would say yes. So from our standpoint, I look at it much more as: I did this research, we created this model or this methodology or this knowledge that will help someone and we've wrote [sic] it up and someone said it was good enough to be published. So, I know I write, but it's almost as though I write as a vehicle to be able to get the research we've done out. I don't think of myself, I don't feel like my writing is making its own contribution like someone who's written a poem or a story or a book or

> something. If I had never published something, I wouldn't consider myself to be a
> writer, even though I would have probably written a bunch of stuff. For me, it's
> from the context of, yes I am a writer because I wrote this and this and that. (23
> June 2014)

Here, she brings up the notion that because her writing is not poetry or fiction, it is not writing in the same way; therefore, she does not think of herself as a writer as she would if she had published a novel or more creative texts. She emphasizes that as an academic engineer, writing is a form of action, and it is the method through which knowledge is communicated and conveyed. It may be that her enjoyment of fiction and her admiration for good storytelling affects her response, and her experience as an active reader possibly underscores the clear differences between "creative" writing and engineering writing. Additionally, her awareness of distinctions among various genres may also be heighted by my presence as a writing researcher asking questions about writing from a humanistic perspective. Regardless of where this awareness originates, Christine understands how the genres she regularly uses as an engineer do not permit the more creative features she encounters in her reading.

Her awareness of those differences thus enabled her to position her own writing firmly within the generic conventions of her particular discourse community, revealing her genre awareness both in her own writing and how she trains her students to write. A primary feature is that research or administrative writing is rarely done alone, and Christine has graduate students assisting with those writing tasks:

> In the research, there's lots of writing. We do modeling, and we do data analysis.
> A lot of my students do the bulk of that work, right, so I give them the guidance,
> and we may go out and have meetings, but they're going to analyze the data once
> I give them instructions on how to do that. So a lot of what I do involves writing
> the proposals to get the funding because a lot of our work is funded through
> grants, so I write the proposals to get the money in, and then […] I'm writing
> monthly, quarterly updates to the sponsors. And then in the context of the writing,
> we write conference papers, we write journal articles. It's rare that I'm a single
> author on a paper. I work with a lot of different faculty. And I always, I almost

always have graduate students involved. I probably have not written a paper entirely on my own, or even a final report entirely on my own, for thirteen years. I think I had one project when I was an assistant professor that was by myself and there wasn't a student. (23 June 2014)

Thus, she understands that in her discourse community, writing is a collaborative task, yet she also acknowledges how much of the writing belongs to her or is a result of her guidance:

I do write a lot, from the standpoint of the journal articles and the conference papers, […] it is probably extensively rewritten if you looked at the actual words that exist in the paper at the end. It may be that the majority of it might be mine. But the students will write the literature review. I mean, I will give them the advice on how do you do your search, how do we organize the search, what papers do you then go for, what is the analysis of that search look like…but then they'll bring it to me, and I'll say, "Let's add another column for this, or let's shorten this," and then we'll move that into a paper, and then I work on making sure that it's something that other people will find pleasing to read. But it's rare in my job, and it's because I manage multiple funded projects that all have graduate or undergraduate students on them, and so it's rare that I'm sitting here and writing a paper on my own. (23 June 2014)

Her awareness of the features of genres such as proposals, conference papers, and journals is clear in her successful publication record, and she often has a heavy hand in the writing or rewriting of those articles, even though she is never the only author listed on the paper.

In addition to her research publications, Christine uses her genre awareness to teach her graduate students to be successful writers themselves. As the quotations above indicate, Christine provides guidance to the graduate students she writes with, essentially training them on how to research and craft a journal article for publication. The ability to train her graduate students effectively requires Christine to deeply understand the genres she uses, including an awareness of the range of audiences an engineering writer might appeal to as well as understanding the goals of writing up the research. When I asked Christine about how she stresses the value of writing for her students, she said:

For my graduate students, it's very much in the form of papers being, journal articles being accepted and published. And that's almost just an articulation of the

contributions they make from a research standpoint. But it is a big part of their process here, you know, to make sure they can start with an abstract and then outline and be able to tell a story that everyone can understand it, and make sure they also understand it's a historical record of what's been done. […] So I think for my graduate students it's more about being able to express things in a concise and clear manner. (26 Jan. 2015)

Christine's sense of the important takeaways for students focuses not on matters of style and form—though those things matter too—but on their understanding of the function of scientific writing within the community. Here, she understands what effective writing in engineering should do: it conveys the story, it provides a historical record to enable subsequent researchers to recreate the study, and finally it does all this in the proper way from abstract to conclusion in a style that is acceptable by the journal editors and fellow engineering researchers.

Despite Christine's hesitation to claim a writer identity for herself, her knowledge of genres and her ability to effectively convey those genres to her students demonstrates that genre awareness is essential to her work as a researcher and adviser. Her awareness of the genres of literary studies or English also reveals her awareness of not only the genres of engineering but also other disciplines. Thus while my presence as a member of a more creative, humanistic discipline created some anxiety as she discussed her own writing, it also enabled her to articulate the ways engineering genres necessarily differ and the reasons why those differences occur. Most of this knowledge is due to her education—Christine purposefully took writing-intensive English courses for her electives as an undergraduate student—and her literacy experiences as an avid reader of fiction and other non-engineering texts. While she produces little or no writing in these other genres, her literacy experiences provided an education on the choices available to writers and a set of texts against which to compare the technical writing typical of engineering.

Emma

Emma too demonstrates some facility with a range of genres, including grant proposals, reflective writing, scholarship applications, and technical reports. As a student, Emma's literacy narrative was at an interesting crossroads. She was in the process of being socialized into the engineering discourse community as she wrote more technical reports and other engineering genres, yet her acquisition seemed to her to come at a price. "I definitely feel like I'm losing my creativity as I take more engineering classes," Emma complained as we discussed her writing in engineering, "and I hate that." She continued, "I used to be really a huge creative thinker. And my imagination still runs pretty wild, but I used to be able to sit down and write it out. But now I'm having a really hard time writing things out because it flows against what I'm learning in school, and I hate that. I'm just trying to find a good balance" (16 Dec. 2014). Her comments echo Christine's insistence that engineering writing was not creative and that the two exist as distinct forms of communication.

As Emma delves further into the world of technical communication and engineering reports, she finds that her voice is changing and that she is not thinking in the more markedly creative ways that once characterized her identification as a writer. While Emma might feel that she's losing something, it's likely that her exposure to multiple genres is changing how she perceives herself as a writer. Whereas both Katy and Christine are well-versed in engineering communication, Emma is in the midst of that socialization into her discourse community. Because of her extensive experiences in other, more literary genres runs counter to her immersion into a new way of communicating, Emma is undergoing an identity crisis as a writer.

Gee (2004) addresses issues of identity, focusing on the situated nature of literacy and learning. One argument he makes is that the acquisition of specialist language requires a loss or a

leaving of older varieties of language, a sacrifice a student will not make unless she understands

the new language as a gain (Gee, 2004). He remarks:

> Specialist languages are tied to socially situated identities and activities (i.e. people use them to do things while acting as certain kinds of people with characteristic viewpoints, values, and ways of acting, talking, and believing). People can only see a new specialist language as a gain if: (a) they recognize and understand the sorts of socially situated identities that recruit the specialist language; (b) they value these identities and activities, or at least understand why they are valued; and (c) they believe they (will) have real access to these identities and activities, or at least (will) have access to meaningful (perhaps simulated) versions of them. Thus science in school is learned best and most deeply when it is, for the learner, about "being a scientist" (of some sort) "doing science" (of some sort). (Gee, 2004, p. 93).

For Gee (2004), identity is crucial to learning, and Emma's frustration with what she perceives

as a loss of one identity is also marked by the gain of her engineering identity. Here, her growing

awareness of genres and the ways technical reports and other engineering forms of

communication are distinct from other "creative" writing is indicative of her learning process. If

she did not feel this conflict, Gee suggests, she would neither be in the process of acquiring that

identity nor learning the knowledge to be an active participant in an engineering community. For

students unable to develop this identity, their learning would not be as meaningful or connected

to a larger world of professional practice. Thus, despite Emma's discomfort with these new

forms, she values her emerging engineering identity, which in turn enables her to be aware of

and actively learn the conventions of the technical genres she had encountered and will continue

to use as a student and as a professional.

As a sophomore, Emma has been exposed to a range of genres both in and outside of

engineering, and this exposure has influenced how she responds to writing situations. When I

observed her writing the reflection she had to submit as part of the requirements of the CGI grant

her student group received, she displayed her understanding of this particular genre and how she

could use it to meet the reader's needs. The reflection, submitted quarterly, was meant to be a record of what had occurred since the last reflection to keep the granting institution up-to-date on the project's progress as well as how they were spending the grant money. With the particular refection I observed Emma crafting, however, she was aware that she was writing to a new reader, one who was not as familiar with the project as the previous person she submitted the reflections to. To accommodate that new reader, she worked in references to the history of the project to make sure the new audience understood the context of the project.

In addition to accounting for her audience, Emma also considered what style she wanted to use to get her points across successfully and appropriately. In this particular document, she was trying to balance between "a diary feel," which she did not feel was appropriate, and a more professional document.

> They usually have a diary feel, then afterwards I kind of tone it down a little. I still keep it in there a little bit because that's my personality. […] When it comes to a mandatory writing, I like to maintain my voice because I don't want them to feel that I'm not taking this professionally. So I need to come off a little more professional than I would in other circumstances. (19 Sept. 2014)

When I inquired about why she felt the need to come off as a professional while balancing the "diary feel," she said:

> The engineers would definitely come off a little more professional, a little more tactical […] And I feel like with our project, it's not just tactical, it's really engaged with the community, so I do want to come off a little bit more, like I do like the diary feeling, so I don't want to take that way because I feel like our main goal with this rainwater catchment system is not only to make [the farm] water sustainable, but it's also to bring the community together and teach people how they can have an impact on their environment, on their water savings and stuff like that. So I don't want to come off, I don't want it to be all tactical, but I do want to make it a little bit more professional. (19 Sept. 2014)

One thing to note here is that when Emma uses the word "tactical," it seems that she means both strategic and "technical"—she perhaps conflates the meaning of tactical and technical, using one

where she means the other. Most importantly, though, is that she recognizes the need to have a somewhat professional or technical voice, but knows the danger of going overboard. When I asked her if this reflection would be a form of engineering writing, she replied yes because it was her as an engineer writing for a non-engineering public:

> I feel like this would be the type of writing I would send to the public, does that make sense? Because engineers, we're not just talking to other engineers, we have to communicate in a way that is easy to understand by the public. And so we can't use technical words all the time, and we can't have very tactical ways of writing, to not only get the public's attention and keep them engaged, we also have to do it in a way that's clear and easy to understand. So I kind of like doing this technical writing because it teaches me how to explain it to the public. (19 Sept. 2014)

It is this ability to think about writing to various audiences that is a sign of Emma's current and future success.

Here, this sensitivity to audience is indicative of her genre awareness. In the reflection, she is taking up the identity as a project-lead and engineer to inform a non-engineer of the progress made. She understands that the situation enables her to write a little more informally, yet she also strives to maintain a professional tone as she writes. A sample from the version she submitted reveals her ability to do just that:

> Our objective was to clean the tanks and set up half of the barn's guttering system. Surprisingly, the cleaning tanks task proved to be more challenging than the guttering system task. [A food company] had donated the tanks to our project for free, but they still contained a small film of soy lecithin residue to be disposed of before use. The soy lecithin is a nontoxic food-grade ingredient found in most [brand name] snacks. The problem we encountered was how to clean the tanks of the residue without getting the soy lecithin all over [the farm's] gardens. We tried using a power washer and Dawn soap, but ended up making a huge mess and wasting a lot of water in the process (which goes against our purpose of making [the farm] water sustainable).

Stylistically, Emma manages to balance her more technical or engineering style with the "diary feel" that she notes was potentially problematic in her early draft. Mostly, the final draft contains little that might be seen as diary-like and focuses more on detailing what happened with a

professional, yet accessible voice. The shorter sentences and certain phrase use would be more characteristic of engineering writing—phrases such as "cleaning tanks task" and "guttering system task" represent the nominalization that frequently occurs in STEM writing (Halliday & Martin, 1993). Additionally "film of soy lecithin residue" may also be read as more scientific, though a STEM writer would not say "small," as she would likely quantify the residue in some way or delete the adjective. While the overall tone approximates that of professional engineering, Emma is careful to make accommodations for her reader: she includes a brief definition of what soy lecithin is, in case her reader was unaware, and she portrays the struggle that the group faces as they attempt to clean the tanks, only to expend more water in cleaning them than the tanks would save. This drama is part of the story she wants to tell, an element that would engage the reader and demonstrate the problems the group encountered and how they solved that problem. By incorporating this narrative element, Emma displays a feature common of scientific writing— the need to tell the "story" of the research (Goldbort, 2006; Schimel, 2012)—as well as the awareness that storytelling—or creativity—is the best method to engage her non-technical reader. Emma's awareness of this particular genre is evident in how she blends technical and non-technical uses of language in a way that accomplishes her goal.

Creativity and Technical Writing

Interestingly, each participant had a different understanding of the role of creativity in engineering writing, which was connected to her literacy experiences and approach to engineering writing. As discussed above, Emma is aware that creativity is useful as she writes her reflection, though she struggled to reconcile her desire to be creative with her growing knowledge of technical genres. In our discussions of the role of creativity in journal articles, Christine insisted that the research is where the creativity in engineering emerges but remarked

that the writing itself is primarily a record of what happened, a reflection of the ideological stance common of research scientists. She comments at one point, "I think of it as there's creativity in the research that happens. As far as writing it up, I feel like I'm just writing up what we did;" later she remarks, "There's just not a ton of creativity to it. The work itself is what makes it unique" (20 Jan. 2015). So while creativity did seem to play a role in the generation of new knowledge in engineering, for Christine it was not a component of engineering writing. Emma too echoed this sentiment: when asked if she believed creativity had a role in technical writing, she remarked, "I feel like it's, in the design process, it does, but in the writing, no" (16 Dec. 2014). Both women recognize that while creativity does have a place in engineering, it would be problematic to approach technical writing with the same frame that one approaches both the reading and the writing of more literary genres.

During her participation, Emma was in the midst of struggling with feeling like she was losing her creativity, which may be in part because of her socialization into engineering genres. Between our first and final interviews, it seems a shift occurred in how she thought about herself in relation to creative and technical writing. In her intake interview, Emma described herself as a creative technical writer, noting how she used metaphors to illustrate points and engage the audience. However, in our final set of interviews, when I asked her about the distinction between the reflective writing she produced and the more technical reports she was learning that semester, she commented, "So I feel like […] technical writing, you don't put in that many adjectives, you don't make it all pretty and creative, you just tell them what happened…it has a pretty structured format when I look at it" (16 Dec. 2014). As she developed a clearer understanding of the demands of technical genres, such as the report, she was forced to renegotiate her relationship with creativity and its place in her personal and professional identity.

Despite these conflicts over what is and is not creative, it would seem that creativity does have some role in how these women produce engineering genres. All three women recognized a sense of themselves or their own style within their writing, though they perhaps had a hard time identifying exactly how their styles might differ from their peers'. For instance, Christine commented that

> It's interesting. Like our work is not that creative so it's not. I don't know, I don't know how easy it would be to distinguish between like other people that I think write papers well I don't know if like, I don't if, it's hard for me to answer that. I'm just not as familiar with writing styles. (20 Jan. 2015)

Emma explained that in the process of writing reports as a group, she recognized how each person did in fact have their own style, which they had to smooth out in the final document, though she noted "individuals can be seen and noticed. But you're really not supposed to be because it's not about you as a writer, it's just about the process" (16 Dec. 2014). So while there is room for individual choices, preferences, and style, the individual should not stand out

Pleasure and joy as a product of writing may also be connected to "creativity." For example, as Emma composed her reflection for the CGI grant, she commented on pattern or parallelism in writing as "literary" or creative:

> And I like to keep that pattern as well. See how I keep saying on August 12th on August 30th on September 7th […] I like patterns because I always feel like that's a literary element that people take for granted nowadays, and I feel like patterns are important. […] It adds not only neatness, but it also adds kind of a nice, a nice quality, kind of like a poem, you know how poems have patterns? I feel like patterns add a nice poetic quality. And I like to put things next to each other […] I like to do those things to because it makes me happy. (19 Sept. 2014)

In this way, perhaps the creativity emerges in the pleasure Emma gets from producing writing that she saw as *good*—she appears to take joy in specific elements that she recognizes as "nice" that enable her to create a specific effect. For Emma, it's possible that as she feels more

comfortable with technical style and takes pride in her engineering writing, she will, like Katy, feel the joy and satisfaction of producing what Katy calls "a damn fine report."

Classroom Applications

As noted earlier, composition researchers and instructors have sought ways to use genre theory to inform the teaching of writing. For instance, Bawarshi (2003) applies his theory that invention begins within genre rather than the writer in his own courses by asking students to analyze common genres. He even includes a discussion of common classroom genres—i.e. syllabi and writing assignment prompts—to demonstrate how genre shapes those documents and gives rise to the genres students produce and relationships enacted in the classroom (Bawarshi, 2003). In STEM contexts, however, if genre theory is used, the focus is more on acquiring specifically STEM genres, while ostensibly neglecting other genres. This neglect that may lead writers such as Christine to have a harder time claiming a writer identity for themselves despite their demonstrated ability, or for writers like Emma to feel a conflict in or a loss of identity as they acquire the genres necessary for successful engineering communication. Here, I argue that while a focus on common STEM genres such as reports, research articles, proposals, and other workplace writing prepares novice engineers to take on the challenges of professional writing, we should not neglect the benefit of an exposure to a range of writing outside professional contexts. As I'll examine in the final section of this chapter, for instance, reflective writing has the potential to enhance writing education and enable engineering students and professionals to craft their writer identity.

Explicit attention to the features of key genres, then, can work toward developing writers who are aware of why writing differs from context to context. In other words, exposing writers to genre theory can cultivate an awareness of features, how they are rooted in disciplinary norms,

and what actions they are meant to accomplish. In addition to focusing in on the genres typical of academic and professional engineering, instructors should also encourage students to consider the range of genres they already actively use, comparing them with one another to understand the ways that specific genres permit or constrain writers within a given context. This attention to genre is also beneficial if the course instructor is trained in engineering because frequently users of genres are not always conscious of their acquisition of ways of speaking and writing in their discourse communities and may fail to understand why students struggle to write appropriately. For instance, most students come into engineering classrooms with the writing experience in more humanistic disciplines such as English or history, and if they take freshman composition, their instructor will most likely have a literary background. Their main academic writing experiences may involve genres typical of English or "the academic essay," genres that do not work well in engineering contexts. If both the instructor and the students engage in some explicit discussion of those differences—and the underlying reasons *why*—the students may more easily grasp that the rules in engineering settings differ and that while they may struggle, they are working toward learning that new form of writing.

Some struggle is inevitable, but the classroom space should function to allow students to fail and to use that failure to fuel future writing. In other words, failure to produce appropriate writing is not a failure to learn; it can be transformed into a learning opportunity if the instructor and student are willing to continue experimenting and testing. Here, revision is one strategy that can enable students who perhaps have trouble moving from one context (English or "academic" essay) to the new discourse community. Through revision, students can respond to instructor feedback, reconsider their choices, and continue working toward acquiring the genres. The dynamic learning environment that sets students up for success by accepting the possibility of

failed attempts echoes Gee's (2003; 2004) call for classrooms that encourage learners to try and do. In other words, Gee (2003; 2004) advocates active learning environments that *situate* learners and are focused on an active acquisition of concepts rather than rote memorization of facts.

Mentors, Role Models, and Writing Education

As the research on genre as well as workplace writing indicates, mentors and role models are one way novice writers are immersed into their professional community. Mentorship was a common theme for each of the participants, a factor they returned to repeatedly. In fact, at one point, Christine slipped into a mentorship role for me, as she understood the path to full professor status and the need to protect one's time from the various demands placed on it. For instance, when I offered to talk to her class after she complained that she could not get anyone from the writing center or English department to work with her, she hesitated and deferred accepting because she wanted to make sure I had time to complete the research that would mean more for my success. Her own ability to say "no" to what Adam Grant and Sheryl Sandberg (6 February 2015) refer to as "office housework" and to strategically choose that which she was motivated to pursue and what would enhance her own career makes her a good role model and mentor for those entering academia. For these three women, their mentorship relationships were formative both in their acquisition of a professional identity and in their writing education.

The Professional Experience

Both Katy and Christine highlighted the necessity of a mentor for their professional development overall, but more importantly for this project, to their writing education. Katy's advice to all new professionals is "Get a mentor" (17 Dec. 2014). She saw her relationship with her direct supervisor and mentor as invaluable; she learned specific genres from him as well as

stylistic considerations. He was someone she trusted and someone who was invested in her success. Her mentor commented that writing ability was something that Katy came to the company already possessing, and Katy stressed that his mentorship was influential in her socialization into that particular corporate environment as well as the profession of civil engineering. Katy also serves as the practitioner-advisor for the student chapter of the American Society of Civil Engineers, a role she sees as providing some advising and mentorship for those students, and she has volunteered her time to talk to technical writing classes at the university to share her writing experience. Because she has benefited from the relationship with a mentor invested in her success, she understood the role and function of a mentor.

Christine also cited her dissertation adviser as a mentor for her success in engineering. From that adviser, Christine learned the most about the genres of writing that are essential to her work as a researcher:

> But certainly when I did my dissertation, my adviser would have crafted, she would have taught me what is the content of a conference paper, how do you write your ideas so they can be communicated…so I would say the bulk would have been either on research assistantships where I was writing for that project or my dissertation and working with the faculty member in getting that stuff written and submitted. And so I did publish conference papers and journal articles when I was a student, and then after I finished, that were related to my dissertation. That's probably where the bulk of my writing experience that's most similar to what I do now would have come from. (23 June 2014)

In graduate engineering programs, the adviser-student relationship is a crucial location for mentorship. A good adviser will ensure that a PhD student learns how to submit proposals, present at conferences, and publish in journals; in fact, graduate education in STEM relies on this model. Given that most articles in STEM are coauthored and that articles rather than a book are the standard publication for academics, it is not uncommon for dissertations in STEM to be essentially three articles with an introduction and conclusion, and those articles will likely be

submitted for publication with the adviser as a coauthor. Given this structure, mentors should ideally model writing for their graduate students to train them not only how to be successful as an assistant professor on the tenure track, but also to become a mentor for their own graduate students.

The Student Experience

Katy and Christine's experiences demonstrate how they were the product of successful mentorship relationships , but how does one acquire mentors at the undergraduate level? Although she has only been at the university for a year and a half, Emma revealed that she purposefully seeks out mentors wherever she can find them, whether it be family, peer, instructors, or anyone else she saw as possessing knowledge that could benefit her education. Emma's curious nature and desire to learn more was evident each time we met. For instance, in our initial intake interview, she demonstrated just how quickly she could learn a concept and use it: at the beginning of the conversation, I asked her about the kinds of writing she did, using the term *genre*. She expressed that she had a hard time categorizing her writing in terms of genres because it was not how she thought of writing, and thinking of genre this way was foreign. Yet later in the same conversation, she uses the term to respond to my question about how she applied the lessons she learned from writing reviews for a research project she was part of:

> It really helped me think about who my audience was or is as I'm writing and what point I need to get across. I used to think writing was just an expression of yourself, but now I understand that there's so much more to it than just expressing yourself, you need certain genres because there's just so many applications of writing that you have to categorize it to different genres. (25 Aug. 2014)

Her flexibility and use of any learning opportunity became clearer upon reflection when I understood better how she consciously sought out mentors and took advantages of any lessons that were offered to her, either formal or not. I realized that although I didn't mean to, I would

stop to explain concepts and talk about writing ideas, unconsciously slipping into a mentor role because I loved to talk about the topic. And Emma listened carefully in those moments and took away what she found useful because she saw me as a writing expert—and at the end of the study, I realized that our interaction had been formative for her.

However, I was a minor mentor compared to the many other individuals who have been part of her writing education. Emma has formed mentoring relationships with anyone from her mother to her peers to her professors, using each of these relationships to develop her communication skills and deepen her knowledge. As a first-generation college student, she has had a number of mentors and networks available to her through an organization called Student Support Services (SSS) and the Engineering Career Awareness Program (ECAP). In fact, Emma and I first met when I gave a presentation about academic writing to a group of SSS students, and she caught my attention with her active participation and thoughtful comments. Before she entered the university, however, she had her mother as a mentor, a person who Emma continues to call on as a resource for her writing education. She typically calls her mom and reads her the paper, and "if she doesn't understand it, then I have to go into more detail, and I know I need to add more stuff. Because she's extremely intelligent, but sometimes the engineering, the technical words, they'll bypass the normal everyday person's vocabulary, so they need more explanation" (16 Dec. 2014). Emma remarked that her mom "encouraged [her] to look at it in a different way" (25 Aug. 2014), which may have contributed to her audience awareness and her ability to think about how the needs of engineering and non-engineering readers differ. She also cited her high school AP English teacher and counselor as contributing to her writing development. At the college level, her professors as well as the research assistant who supervised her writing as part of her internship with the sustainability office also served as mentors.

Emma's peers exerted a significant influence on her writing education, and she consciously looked up to them as mentors. There was Kimberly, a fellow engineering student with whom she applied for the CGI grant who offered feedback on Emma's writing: "I've learned through her showing me a different way of saying things," she commented, though Kimberly's revisions were often "a little harsh" (16 Dec. 2014). Despite Kimberly's harshness, Emma also characterized her and Kimberly's work together as an ideal collaboration because they were able to bounce ideas off of each other and work cohesively to accomplish their goal to win a grant from CGIU. Additionally, in Emma's biological engineering design course, it would be Casey, her classmate (and later friend) who would become a peer mentor as they wrote their reports together. Emma looked up to Casey and valued her writing expertise and sought to learn from it:

> She was definitely the best editor out of both of us, […] she's just really gifted when it comes to English and the grammar and like which word to choose, like which one's the best to use. Like I use a thesaurus, that's my gift. [laughter] I can tell when something doesn't sound right, but she just comes up with the answer pretty fast. And that was kind of intimidating to see, but it was also really helpful to listen to her process and how she like came up with those words and stuff. I feel like I learned a lot from her, just editing with her. […] I learned to be more concise. I know when she was reading my portion, she took out a whole paragraph, and that hurt my pride so much because I was like 'I spent a long time on this,' but she took out the whole paragraph, and it made much more sense when she took it out. (16 Dec. 2014)

In both peer mentoring instances, Emma felt a little cowed by what she saw as an exhibition of higher writing ability, yet she did not let the intimidation keep her from using the mentoring relationship from improving her own writing. She intends to maintain a mentoring relationship with Casey, whose writing expertise she could learn from, as well as her personal friendship with a woman she came to see as a "study buddy" and had connections to.

Emma even uses the texts she encounters as models. When I asked her about the connection she drew between her extensive reading and her writing ability, she commented that "I take advice from the books I read" (16 Dec. 2014). She also remarked

> Because I read articles and essays that have been written from such different viewpoints and walks of life that I feel like, because I even read blogs sometimes online just to see how people communicate. That fascinates me, to see how people communicate outside of what grammar has taught us to be correct. So I feel like because I read so many different viewpoints that I'm able to write from so many different viewpoints, so write in a different manner that what might be normal. So I like to push the boundaries a little bit. (25 Aug 2014)

When I asked her how reading so many research articles affected her, she claimed, "Because we see so many examples that it's easy, because we see it on the page, it's easy for us to repeat it, and it looks normal and it looks natural because we've been looking at it for such a long time." In other words, she is conscious of the ways these texts function as models to allow her to learn the rules of technical writing genres and internalize the discourse of the engineering community.

In fact, as she was working on annotated reviews for a project with the sustainability office, she noticed that her writing style would often reflect the style of the article she was reviewing and summarizing:

> I have noticed with my annotated reviews—because some research articles are more informal than others—and so with my annotated review I become more informal in my summary because I want to keep it the same. I want to match it to what the author was talking about because that's not my biasment [sic], that's his biasment. I definitely see that, but I don't know how it works. (25 Aug. 2014)

Given the nature of the reviews she was writing, Emma understood that it was useful to not only accurately summarize the information within the article, but also perhaps to mirror the style used, capturing something of the original in her annotation. Her puzzlement over how she is able to mirror another's style indicates that while she can see after the fact that she has modeled her writing off the texts, she is uncertain how she does it, though she seems to have a good

justification for why it makes sense. What may in fact be happening here is that in the varied writing situations she finds herself, Emma is trying on voices and playing with different styles as she develops a writing identity within her academic and professional contexts. By mimicking the style she encounters in the sources she reads, or by absorbing the lessons from her peer mentors, Emma is beginning to approximate the technical style required of her as an engineering communicator. Here, Emma's identity seems to be in flux, but her willingness to play with her voice and learn from her mentors and models demonstrates a writer in the process of acquiring the skills that will mark her as a successful engineering writer.

Classroom Applications

Mentoring is a concept already found in composition pedagogy, informing staples of writing programs such as peer revision workshops and writing center tutorials. Within engineering and other STEM fields, mentorship is also valued for socializing novices into the field (Winsor, 1996; Leydens, 2008). For women specifically, mentorship is frequently cited as a tool to prevent women from leaving the field as well as enabling their success (Rankin, Nielsen, & Stanley, 2007; Posey, Reimers, & Andronicos, 2007). Mentorship, then, offers many possibilities for enhancing the writing education of STEM students within both schooling and professional contexts. Katy, Christine, and Emma all cited mentors as a primary factor in their writing education, and they were conscious that their success was made possible, in part, because of their committed mentors. As all three cases illustrate, mentorship can take on many forms, whether teacher to student, adviser to graduate student, experienced professional to novice professional, or even peer to peer.

In the classroom, mentorship can be introduced and developed in a number of ways. For one, if a non-engineering instructor is teaching the writing course for engineers, that person

should develop ways to encourage students to seek out mentors among their peers, professors, or practicing engineers in their community. If an engineering instructor is the one incorporating writing into her class, in addition to serving as a writing mentor to students, she can also find ways to match younger engineering students with those more experienced and to encourage peer mentorship among students within their individual cohorts. As Emma's case demonstrates, her peers were formative mentors, and she actively sought out advice from her engineering professors and supervisors. For students less proactive about seeking out assistance from their professors, the classroom space can function to develop those relationships. For example, a first assignment could require an interview with a practicing professional with subsequent assignments building from the knowledge they gather there. Potentially, in a more developed program, there could be professors, instructors, and community partners who are willing to serve as mentors. Finally, peer writing groups can also aid in establishing peer-mentoring relationships, though these relationships may not develop as easily or naturally as the ones Emma developed independently.

For graduate students, Christine understood the relationship between mentorship and writing education. First, she herself serves as their mentor, guiding and shaping their research and writing and training them how to write appropriately for publication. However, she also had some ideas for how to improve writing at the graduate level that involved peer-mentorship:

> I think [the writing center or graduate school] could definitely set something up where there was even peer-review writing, where the students themselves were helping each other. And doing it more their first semester on campus[…]—give them something, it doesn't have to be completely and technically in what they're doing but something where everybody writes the same piece, and then you see how other people write and explain the story. I just feel like there's some education that could take place in a little bit more formal way. […]There's nothing formal in our program, which there could be, there's nothing […]. The [writing center] has been helpful, but I think even something where our graduate students were helping each other and reading and writing, they would have an

understanding of what it's like to. Because they're reading final products all the time, they don't realize what it's like to read something that's so difficult to understand. (20 Jan. 2015)

Christine's idea is based on the ways her postdoctoral research assistants or her PhD students mentor master's students in her lab, which she sees as training for when they have their own graduate students as well as a productive mentorship relationship. For students who do not actively seek out mentors, providing opportunities to seek out, work with, and learn from each other and from the experts will enhance their writing education and their socialization into their engineering discourse community.

Reflecting on Writing Practices

I developed this study in part because I was curious about how skilled STEM writers developed after I found myself repeatedly in conversation with engineers and scientists about writing. With all of the attention to how poorly engineers (or scientists in general) communicate, I was struck by the writing knowledge these individuals demonstrated as well as the care with which they crafted their documents. In fact, Katy and I would often discuss writing at length, arguing about ways of approaching writing and explaining various "rules" that we had encountered. Later, she informed me that she had incorporated these discussions into her professional writing; for instance, when I explained that "utilize" was frequently selected over "use" not because it was a more appropriate word but because it sounded smarter or more elevated, she began avoiding it in her own writing unless it made sense as a stylistic choice. Likewise, she learned the distinction between e.g. and i.e. when debating with her partner, also an engineer. Katy enjoyed thinking about language and style, and did not avoid discussing those topics with me, even if I was seen as the language expert in many settings. And while she

certainly was unafraid of voicing her own opinion, she also was willing to learn something new from those situations and use it to continue enhancing her writing.

These anecdotes are revealing in that they show Katy as an individual sensitive to continuing her writing education, albeit informally, as well as someone willing to reflect on her own communication practices. Her quest to improve her writing begins with feedback from her mentors, her use of models, and finally, her ability to explicitly examine her own writing and know what is effective and what could be improved. As discussed in Chapter 2, her dissatisfaction with not only the process of composing the meeting minutes but also with their style and length led her to fight to change the composing process. Moreover, her use of past reports as models was possible because she was able to reflect on how they were constructed and how they were effective or ineffective.

For Christine, my asking her to reflect on her writing and on herself as a writer had two effects: one, she grew more aware of writing as more than communicating her ideas, and two, she began to rethink her approach to how she trains her students. When I asked her what she though the impact of this study had been on her, she replied:

> I guess it's interesting because in talking with you, I think of writing of more of like a form of expression, of something you can actually hone and improve. And for me, it's not like it was a necessary evil because I don't mind doing it per se, but […] for me I've never thought of my writing as an entity on its own. It was just a way to articulate the work I had done. Which is pretty interesting, […] until we started talking about it, I had never really sat down and thought about my writing as an entity of itself. As opposed to [thinking] "well, I did this work and we want to pass it along to other people, so I'm going to have to write about it." Not so much thinking about writing a paper. I don't tend to think of myself as a writer, which I guess after this, I do a little bit more think about "well, I guess I am a writer." [laughter] Obviously because I'm like 'I'm a professor and I'm an engineer […]—sometimes, my kids will say things like 'we met someone today whose name was in our textbook' or something. And I'm like 'yeah, I have my name in some textbooks, interesting.' […] It's just funny because I tend to not think, 'oh, look at this article I wrote,' I think of it as more 'look at this work I did.' And it's true that it had to get written up, and I know the value of those

papers, but I almost think of them only as a way to communicate what I had done, which is kind of interesting. (26 Jan. 2015)

Christine's comments demonstrate some of the power of reflection on enabling engineers to form a writer identity and to understand writing's place within their professional lives as more than communicating new knowledge. Despite her success in publication and her recognition that her writing is strong, she seemed reluctant to accept that "writer" could be a part of her professional identity. Through the process of reflecting on her writing in order to answer my questions, however, Christine began to understand how she could see herself as a writer and as an engineer. Even as a full professor and award-winning writer and teacher, this identity does not always come easily. Yet, her final comments reveal the effect that this understanding will have on how she mentors her graduate students:

> It'll change the way I approach my students to think about things, or even in my classes that I make sure to think about the importance of writing and how the message can get lost if you're not teaching it. I think for me, it'll probably translate in how I help others to write. And to really be cautious to make sure I'm teaching them how to write and not just like being a technical editor. Which is sometimes more efficient but not really part of the mission of what we're trying to do. (26 Jan. 2015)

This response reveals the power of reflection not just for students and engineers-in-training, but also for fully fledged professionals. By reflecting on her writing and understanding it from a different perspective, Christine has the potential to shift how she teaches her students. While there is no way to know specifically what that impact might be, the potential impact could be far-reaching, especially if she is able to ask them to reflect and to connect to a writer identity that is integrated with their engineering identity.

Classroom Applications

Reflection has long been a tool for use in writing classrooms, but its use in STEM courses to enable engineering students to explore their identity and learning is less clear. As

discussed above, if STEM courses focus on writing, they will often focus on specific kinds of writing necessary to scientific communication; they might regard reflection as unnecessary or irrelevant to student education. Several engineering communication researchers, however, point to the potential use of reflection to enable students to integrate writer and engineering identities. Poe, Learner, and Craig (2010), for instance, argue:

> Beyond formative and summative assessment is one final assessment approach that is often overlooked. Reflection, an individual practice observed in some of the classes that we studied, is useful in the individual growth and development not only of students but also of faculty. Reflection is often braided together with assessment. For example, when faculty members articulate standards for professional assessment of communication tasks, genres, and skills, translate those into terms that students can grasp, and then enact those standards in their responses, they can come to a greater awareness of their own understanding of professional discourse. This greater awareness can be clearly articulated to their students, and…the process also leads to further reflection on continuous improvement measures for pedagogy. For students, the metacognitive process of turning inward to integrate information about one's performance is a skill that many students already have and one that is worth supporting. (p. 197)

Here they highlight not only the benefit of reflection for students themselves, but also its potential for faculty to improve their own knowledge of professional writing. The more conscious faculty are of their professional practices and discourses, they better able they will be to explicitly pass those on students. Leydens (2008) also supports the use of reflection as a tool for teaching in that it may bridge the experiential gap that prevents students from developing a writer identity.

Reflection can take many forms from informal journal assignments to more formal reflective assignments, such as the letter often submitted with a writing portfolio, for instance. As Emma herself demonstrated, being asked to talk about her writing and articulate her composing process affected how she thought about writing, herself as a writer, and the writing process. While replicating the conditions of this study within a classroom setting is not feasible,

writing instructors could provide multiple opportunities throughout the course of a semester for students to reflect on their writing both generally and specifically. For instance, early in the semester, instructors could initiate reflection informally through class discussion and in-class writing assignments. Then students could be asked to reflect more formally on the texts they produce as well as the process of drafting and revising to cultivate a metacognitive awareness of writing. I frequently require my own students to submit revisions of assignments, and I ask that they provide a memo that details the changes they made, why, the effects of those changes, and what they learned in the process. Finally, reflection should connect the world of the classroom with the world of the workplace to encourage students to link what they are doing in the classroom with the work they will be asked to do as professionals to underscore the connections between writing and engineering selves.

The Dilemma of the Authentic Learning Situation

In Chapter 2, I focused on Emma's student experience as she crafted an engineering design report. In our discussion of that report, she made it clear that she knew the stakes of the writing she had to do in that context and believed them to not be as great as other writing situations she had encountered. In fact, her admission that the work her group turned in (which still earned a 95) was not as successful as it could have been might indicate that she viewed the assignment as a school, rather than a professional, task. It might seem that neither Emma nor her group members situated the task within a professional context, thus treating it as a school-based activity that was not worthy of their full attention. While this conclusion is plausible given her comments, Emma's understanding of the task indicates that something more complex was going on. Furthermore, we should not dismiss the learning that occurred in that setting as unrelated to how these novice engineers believe they will write outside of school nor as irrelevant in their

development of a writer identity. As I reviewed the interviews, it would appear that compared to

the beginning of the semester when we had our fist discussion, by the end of the semester Emma

had grown somewhat more confident with her writing. More importantly, she was able to more

explicitly articulate the features of technical writing. Her final set of interviews showed that she

was a more mature writer, one much more at ease with technical writing, and one who had a

clearer sense of how she would continue to develop as a writer. She displayed, in other words, a

more clearly defined engineering identity through her writing.

Emma's shift over the course of the semester should not be discounted, and can be, in

part, attributed to the school-based tasks that might be criticized for lacking "authenticity." What

seems to make these learning situations more fruitful is not the authenticity of the task itself but

its relation to Emma's developing engineering identity. Because she has engaged in tasks such as

applying for grants and managing a project with that grant as a member of her engineering

student group, Emma had already come to see herself as an engineer, albeit a novice one who has

much to learn. As Gee (2003; 2004) argues, identity is key to learning that is meaningful. He

examines three types of identity: virtual, real-world, and projective. In a learning situation where

students can interact with all three levels of identity, they will be motivated to connect the

knowledge they gain with their real-world identities (Gee, 2004). He argues:

> If learners in classrooms carry learning as far as to take on a projective identity,
> something magic happens—a magic that cannot, in fact, take place in playing a
> computer game. The learner comes to know that he or she has the *capacity*, at
> some level to take the virtual identity as the real-world identity. (Gee, 2004, p.
> 114, emphasis in original)

Thus matters of identity can affect the learning that takes place in the classroom; in this case,

engineering students who begin to understand themselves as writers may work to integrate that

identity with their emerging engineering self.

Likewise, Poe, Learner, and Craig (2010) also argue that identity affects what students transfer out of a specific classroom context. They discuss one student, Carla, who was uncertain of her emerging identity, who would potentially be unable to more broadly apply what she learned in a specific context:

> Although Carla did see the SciComm writing tasks as ultimately useful, the shifting nature of her future plans and of her identity as a science and engineering student makes the lasting impact relatively unresolved. Carla's case also raises questions about developing a discursive identity when one's future professional identity itself is in flux. How can students' scientific discursive identities be flexible enough to serve them in a variety of disciplines? How much is learning indexed to specific tasks and contexts? In SciComm, the writing task was relatively specific to molecular biology and to the science of DNA polymerase. For students such as Carla with only a weak commitment to that field and uncertainty over her future, distilling larger lessons from this specific task was difficult. (Poe, Learner & Craig, 2010, pp. 37-38).

Unlike another student in the course whose career goals and scientific identity were more secure, Carla struggled to apply concepts to other situations. Leydens (2008) also links identity with the ability to understand how writing and engineering are interconnected, rather than separate. The engineering students and professionals who possessed a writer identity that was a part of their engineering identity had a more nuanced understanding of what writing could accomplish in professional settings (Leydens, 2008).

If those engineers with stronger senses of themselves as writers are more capable engineers, then the challenge, as both Leydens (2008) and Poe, Learner, and Craig (2010) highlight, is to provide learning situations where students can develop that identity. Yet, as Poe, Learner, and Craig (2010) point out, schooling contexts often inherently lack the authenticity that one might find in professional contexts. Leydens (2008) too argues that there is experiential gap that is potentially impossible to overcome while engineering students are in the classroom. The challenge is "teaching skills, abilities, methods of inquiry, ways of knowing, and habits of mind

that are valued by the same disciplinary community that apprentice students have not yet come to know through sufficient experiential contact" (Leydens, 2008, pp. 258-259). He advocates for tasks that are authentic to provide that experience (Leydens, 2008), yet authenticity may simply not be possible until students are fully immersed in their discourse communities (Winsor, 1996). Poe, Learner, and Criag (2010) address that criticism as they comment that "mapping on to future experience is never entirely direct"(p. 193) for much of schooling. Furthermore,

> Writing classes have perhaps been unfairly criticized for this inevitable abstraction or lack of transfer or specific skills, but once again, recognizing the larger goals of professional preparation is key here. Students will learn to write as scientists and engineers by engaging in professional tasks. That writing, of course, will inevitably be professional-like, a novice approximation of the skills they will bring to bear on those tasks once they have the full benefit of experience and additional instruction. (Poe, Learner, & Craig, 2010, p. 193)

Thus, while transfer is not as clear cut as educators may like, students receive a great deal of benefit from writing education that takes place within STEM settings.

If authentic writing situations are difficult to attain in the engineering classroom, what can educators then do to equip students to enter the field? As I have highlighted throughout this project and in this chapter in particular, identity is a powerful shaping influence on engineers, as novices, academics, and professionals. It is that identity that may provide the tools for students to link writing tasks they know to be school-based to professional contexts and to read those assignments as proto-professional. As Leydens (2008) asserts, writing and engineering educators "should…pay close attention to writer identity and opportunities for intersections between writer selves and engineer selves" (p. 259). Additionally, Poe, Learner, and Craig (2010) argue that for all the problem of authenticity and transfer school-based writing tasks present, the classroom offers distinct advantages over professional settings:

> School can be an extremely useful space to learn professional communication precisely because it is a controlled space. In other words, slices of professional

communication practices can be pulled out and taught in school contexts in ways that focus students on those core elements of professional communication. A professional scientist, for example, is unlikely to get a three-month course on making arguments with data, although it would be appropriate and feasible for a CI [Communication Intensive] course to focus on this element of professional communication. And the authentic world of professionals are not always conducive to learning. The authentic work of science and engineering can sometimes be critical, arbitrary, hierarchical, and more about sustaining the status quo than innovation. (p. 189)

If we attend to these issues of identity, then the classroom can emerge as a place where students can try on engineering voices and experiment with genres without facing the consequences of failing in the professional world. This active learning space is the kind of situated learning that Gee (2003; 2004) calls for. So while the classroom space may be limited in what it can accomplish, a great deal of learning and identity building can still occur.

These three women were able to leverage their genre awareness to write effectively, form relationships with mentors that enhanced their writing education, and reflect on their own writing in beneficial ways. These three factors—genre awareness, mentorship, and reflection—provide content and approaches that may be useful to incorporate into engineering education. As was pointed out to me in a discussion of this study, however, these are good strategies for writing instruction generally. Future research will build on the work done with writing mentorship to better understand how it can be a tool to not only ensure the success of female students but in enabling students to develop both a professional and a writer identity. Additionally, writing instruction informed by genre theory that also incorporates reflection may serve as a tool to aid in that identity formation. Finally, we must not dismiss the potential power of writing in controlled classroom environments as lacking authenticity. If students are presented with sufficient opportunities to attempt to write appropriately and to reflect on that writing, they may find these experiences affect them later when they enter the profession, whether they are fully

aware of the lessons while they are in the course as long as they are encouraged to integrate

writing and engineering selves.

Conclusion

A professional engineer who goes to great lengths to ensure her writing is not only effective but also illustrates her professional ability and commitment to excellence. An academic researcher who used writing to attain success all while balancing administrative responsibilities and her family life. A student beginning her pursuit of an engineering career on her own terms, using writing to accomplish social good in her community and seek out educational opportunities abroad. These three women—Katy, Christine, and Emma—are just a few of the many exceptional women who have found or fought their way into the engineering field. They generously shared their stories, their expertise, their writing, and their time with me, even if it was not always comfortable or easy. Without their contributions this study would not have been possible, and it is my goal to make sure their stories enhance the conversations about women in STEM, demonstrating how writing has the potential to both enable and undermine women's success.

Because women are so underrepresented in STEM fields, especially engineering, this study presents portraits of successful women, or a woman with the potential for success, to show their place within the field. However, these women do not represent the average engineer—their abilities and their hard work place them firmly at the highest levels among their peers, both male and female. As Katy's coworkers stressed, she is capable, intelligent, and one of the best, if not the best, engineers at her firm. Christine's rank as full professor, director of a research center, and dean are clear indications of a high level of success as well. Just a year and a half into her schooling, Emma's own achievements have set her up to go far in engineering, if the barriers in place do not hold her back.

Being a Woman and an Engineer

For all the ability these women possess, they are still not free of the biases against them in engineering. Katy and Emma particularly shared with me stories that demonstrate that for as far as the field has come, there is still much work to do. For Katy, the knowledge that sexism was very much a part of the culture of engineering did not develop as part of her university education. She realized that gender was still an issue only as a professional, as she realized the subtle and overt forms it can take within her organization and in her professional interactions. In reply to my question, "How have you experienced engineering differently because of your gender," she explained:

> It's funny because I think if you had asked it when I was in school, I would have said not. Because I remember going to a women engineering thing and we talked about sexual harassment experiences, and I didn't have anything. I was just like yeah, I'm rocking. And no one has told me otherwise. And maybe I did and didn't realize it, but I was full of fervor and kicking ass, so it just wasn't something that I recognized or paid attention to. I just saw obstacles and thought I'm going to defeat those obstacles. I mean, school was hard enough by itself, so I wasn't thinking that it was harder in some capacity. In some ways I actually thought it was easier because professors […] would be like "oh it's a pretty girl, and she's really smart! We should find some scholarships for her." I mean, we stand out in a crowd, so that definitely, I'm sure that was the case too. Not to discount myself too much because I worked really hard and was bossy about such things, you know the squeaky wheel gets the grease kind of thing, like when you're up in everybody's business all the time, they're going to be thinking about you. (17 Dec. 2014).

Katy's experience of her gender helping her stand out was akin to what Christine described in her own story of success. Unfortunately that narrative would change after Katy had worked in engineering for some time, and especially after experiencing sexual harassment and other more subtle forms of discrimination. In fact, Katy pointed to that positivity, the culture of support in academia, as perhaps one reason she did not encounter barriers to her success at that level:

> I'm sure [gender has] had a deep effect in various ways. In positive ways as far as in school being a woman because I'd stick out a bit and then in negative ways.

> More negative as being in the profession. Maybe that says something about academia, saying "hey we're supporting women so we want to pay special attention to these people to give them a good experience and try to retain them." (17 Dec. 2014)

Katy pointed to her comfort level with men—many of her best friends are men, and she is used to working with men after going through school with mostly-male classmates—as one reason she never felt alienated while in school, though she did notice that her few female classmates were often quieter and less assertive than she was. Yet, she also realized the cost of often being the only woman in her field:

> I was just thinking about it in terms of who I work with on a day-to-day basis. But when you go to, like I go to [a city], they're all men. All the people, the engineers, the people on the council, the people who work at the plant, they're all dudes for the most part. On a rare occasion, I'll find a lady, and she's almost inevitably the secretary or she works in the lab or does both. It's like these very defined roles. Except on rare occasions where you find somebody who's outgoing and ambitious. I literally cannot name a public works director or city engineer who's a female right now who I've worked with. Which is sad and depressing. It's the good ol' boy thing. They sit around and talk about guns and hunting—I don't necessarily want to define those as manly activities, you know, but in a way they are I guess. At least for this area. And so I feel like a lot of the conversations they have are inclusive to their hobbies. (17 Dec. 2014)

In a way, not only because she is a woman, but also is unable to meet with these men on a cultural level—she is a vegetarian, a fact that so many of the men she works with find difficult to comprehend—means that she is often isolated in their informal conversations and interactions and occasionally is alienated. They may respect her and value her work, but she may also not quite belong.

This sense of belonging is crucial for women in engineering, yet it is something they frequently lack. Unlike Katy, who only began to feel out of place as a professional, Emma told stories of feeling isolated in her engineering courses, especially where she was in a very small

minority. One story was about how male students treated women in a large, male-dominated

Statics course (taught within mechanical engineering):

> I feel like girls are more inquisitive by nature, and so whenever, like let's Statics for example. Statics is a male-dominated classroom, there's over 100 students in there, the majority males, very few females, it's a mechanical engineering class. And you can feel the tension with the competition. Like boys are constantly raising their hands, trying to answer the questions faster than other people. And anytime a question is asked, and it's usually by a female, usually the only ones who ask questions are females, there's only been one by that I've ever seen ask a question in that classroom, the majority of the time, it's by a female, and every time someone asks a question, you could hear behind me or in front of me snickering and like, "that was a stupid question. Why would they waste time asking that question." And it really is disheartening and makes you afraid to ask questions because they're so competitive, and they put you down for it. […] I don't think that's fair because I feel like girls, like every girl I've talked said "that was a good question, I'm glad she asked that question, and she's definitely braver than me" because you can hear everyone judging you for that. It's really saddening. But I feel like when it comes to the males and females in engineering, I feel that the females have to work so much harder than males because it's such a male-dominated world and males just seem to get mechanics, they're assumed to understand these hard sciences than females. (16 Dec. 2014)

Emma herself noted that she was not "brave" enough to ask a question, and her story is revealing

of a culture that women still face in academia. While Katy was unaffected by these attitudes,

perhaps because she was so confident in her intellectual ability that she knew she was one of the

smartest, other women may not be able to ignore or deal with these situations successfully. When

I asked Emma if the environment affected her performance, she replied:

> Oh yeah. I couldn't ask questions. I felt way too nervous to ask questions. And the time I did ask a question, in drill, because you feel a little more comfortable because it's late at night, everyone's more relaxed, I asked [the TA] a question, and he walked all the way up to our table and stood right in front of us and explained it to us. It was weird, because he never did that with anyone else. He would stay down in his little area and explain it. But he walked all the way up to our table and explained it to us. And it kind of…I don't know, it felt intimidating when he did that because he got so close to us and he didn't do that with anyone else.

Every person at her table was a woman, and this incident only highlighted how different she was in the classroom. Because she felt uncomfortable and out of place, she was unable or unwilling to call on her usual resources—mentors and her own curiosity—and her performance suffered. This course was the first course in which she received a B, and one where she was told she simply did not work hard enough, even though she studied daily and did everything in her power to be successful.

Given the climate these women work in, it would be surprising if none of them ever questioned their abilities or indicated that they were less than capable. Indeed, both Katy and Emma expressed doubt in their ability throughout their participation while simultaneously demonstrating confidence. I was struck by the way Katy and Emma would speak confidently of their writing and their knowledge in one breath, and then display hesitation the next. These two women particularly demonstrated features of what Pauline Rose Clance and Suzanne Imes (1978) define as the "imposter phenomenon," or the feeling that despite a high level of achievement, they are not as capable as they seem. A feature markedly more characteristic of women than men, the imposter phenomenon strikes women who are highly intelligent but who likely feel somewhat out of place. It is also typical of individuals who know how much they do *not* know. Katy and Emma are both curious, intelligent women who understand that there is always more to learn and more to know, and while this often fuels their pursuit of more education, it also can occasionally make them feel like imposters. Combining that awareness with feeling marginalized by engineering culture, it is no surprise that they might occasionally— or often—doubt their abilities. When I asked Katy how she might continue to develop her writing ability, she voiced anxiety that she was not doing enough and that she was "a total continuing education slacker" (17 Dec. 2014). Emma also responded that she wanted to take

another class to learn more because she still did not feel completely comfortable with her writing, despite the grants and scholarships her writing had helped her earn. Both of these responses indicated that they felt they should be doing more, when in fact they are already open to any learning opportunities that come their way—it is what makes them such good writers. Christine responded to the same question by simply noting that if she encounters something she believes is effective, she will incorporate it into her own approaches, yet she did not convey the same sense of anxiety or sense of feeling like an imposter that Katy and Emma did.

As long as women are a minority in the field, we cannot ignore the affect these subtle forms of discrimination have on them. A significant body of research exists examining the factors that lead to gender disparity, and the solutions are often the same: make the climate more welcoming to women, change institutions to be friendlier to women, encourage a healthy work/life balance for both men and women. These institutional changes are what Christine pointed to in her discussion of how she was able to be successful as a full-time academic while also having a family. And the lack of changes is one of the reasons that Katy feels unwelcome and occasionally alienated at her firm. Emma's educational experiences in biological engineering have been mostly positive, yet she has already seen the ways that engineering culture can treat women for no other reason than they are different.

Future Research

Future research should continue to explore writing's role in the inequity women face in engineering, as well as writing's function in engineering success. While this study was able to focus on women specifically, one limitation was that there were no male participants to compare the findings against. A similar study might begin by identifying men and women of similar educational backgrounds and writing ability to compare how their educational experiences

influenced their development as writers as well as the role of writing in their success. Because this study argued that writing created barriers to women's achievement, this extension would allow scholars to analyze if the same phenomenon occurs with men, or in what ways their experiences with writing in relation to their success differ.

Additionally, while this study used an ethnographically informed case study approach, a true ethnography of an organization that employs both male and female engineers who are active writers—much like Winsor's (2003) *Writing Power*—would lead to a more in depth exploration of the issues raised by my study. The organizational context affects the work done and the writing produced, so it must be accounted for more thoroughly by future research. Exploring similar questions with an approach more fully grounded in ethnographic methodologies would permit researchers to not only understand the relationship between the context and the writer and their writing, but also how that institutional structure constructs men and women similarly and differently. A study of this nature would also enable researchers to compare the experiences of men and women who work within the same company, thus isolating findings that are a result of the context and those that are the result of individual experience.

Finally, as STEM programs attract more multilingual writers and as English has emerged as one of the primary languages for scientific research publication globally, research that examines multilingual writers, their identity, and professional discourse would be relevant. While these studies could look at both men and women in STEM, focusing in on women specifically would contribute to this project's goal to highlight women in the field and to examine the ways that writing plays a role in the success or failures of women. Given many of the stereotypes about multilingual writers' ability that are in line with stereotypes about engineering writing, research that highlighted those who are able to use writing to succeed could

work to complicate that picture and to better understand writing's function within the quickly changing, increasingly globalized world that is science.

The challenges facing women in STEM are of course complex and many changes will be required before equity for women is attained. In addition to telling these women's stories, my goal was to examine writing's place within the culture of engineering to grasp how it might enable women to reach greater success—or how it might inhibit them. In many ways, it does both, yet I hope this study demonstrates some possibilities for exploring how writing can be used primarily as a tool for women to gain more equal footing in academia and in professional settings. In addition, by examining the ways writing may hold women back, scholars can critique current attitudes that are perhaps the result of a lingering historical legacy. Just as cultures or genres do not develop overnight, neither will radical changes occur instantly. Yet perhaps this study offers another place to begin pushing against the forces that work to create barriers for women.

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Appendix A: Research Compliance Protocol Letter

UNIVERSITY OF ARKANSAS

October 9, 2013

MEMORANDUM

TO:	Jennifer Mallette David Jolliffe
FROM:	Ro Windwalker IRB Coordinator
RE:	New Protocol Approval
IRB Protocol #:	13-09-132
Protocol Title:	*Gender and Engineering Writing*
Review Type:	☒ EXEMPT ☐ EXPEDITED ☐ FULL IRB
Approved Project Period:	Start Date: 10/09/2013 Expiration Date: 10/08/2014

Your protocol has been approved by the IRB. Protocols are approved for a maximum period of one year. If you wish to continue the project past the approved project period (see above), you must submit a request, using the form *Continuing Review for IRB Approved Projects*, prior to the expiration date. This form is available from the IRB Coordinator or on the Research Compliance website (http://vpred.uark.edu/210.php). As a courtesy, you will be sent a reminder two months in advance of that date. However, failure to receive a reminder does not negate your obligation to make the request in sufficient time for review and approval. Federal regulations prohibit retroactive approval of continuation. Failure to receive approval to continue the project prior to the expiration date will result in Termination of the protocol approval. The IRB Coordinator can give you guidance on submission times.

This protocol has been approved for 11 participants. If you wish to make *any* modifications in the approved protocol, including enrolling more than this number, you must seek approval *prior to* implementing those changes.   All modifications should be requested in writing (email is acceptable) and must provide sufficient detail to assess the impact of the change.

If you have questions or need any assistance from the IRB, please contact me at 210 Administration Building, 5-2208, or irb@uark.edu.

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UNIVERSITY OF ARKANSAS

February 2, 2015

MEMORANDUM

TO:	Jennifer Mallette David Jolliffe
FROM:	Ro Windwalker IRB Coordinator
RE:	PROJECT CONTINUATION
IRB Protocol #:	13-09-132
Protocol Title:	*Gender and Engineering Writing*
Review Type:	☒ EXEMPT ☐ EXPEDITED ☐ FULL IRB
Previous Approval Period:	Start Date: 10/09/2013 Expiration Date: 10/08/2014
New Expiration Date:	10/08/2015

Your request to extend the referenced protocol has been approved by the IRB. If at the end of this period you wish to continue the project, you must submit a request using the form *Continuing Review for IRB Approved Projects*, prior to the expiration date. Failure to obtain approval for a continuation on or prior to this new expiration date will result in termination of the protocol and you will be required to submit a new protocol to the IRB before continuing the project. Data collected past the protocol expiration date may need to be eliminated from the dataset should you wish to publish. Only data collected under a currently approved protocol can be certified by the IRB for any purpose.

This protocol has been approved for 11 total participants. If you wish to make *any* modifications in the approved protocol, including enrolling more than this number, you must seek approval *prior to* implementing those changes. All modifications should be requested in writing (email is acceptable) and must provide sufficient detail to assess the impact of the change.

If you have questions or need any assistance from the IRB, please contact me at 109 MLKG Building, 5-2208, or irb@uark.edu.

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