5-9-2016

Composition Assignments with Workplace Relevance: An Examination of Technical Communication Coursework and the Reading and Writing Demands of Professional Engineers

Ann Marie Francis

COMPOSITION ASSIGNMENTS WITH WORKPLACE RELEVANCE: AN EXAMINATION OF TECHNICAL COMMUNICATION COURSEWORK AND THE READING AND WRITING DEMANDS OF PROFESSIONAL ENGINEERS

by

ANN MARIE FRANCIS

Under the Direction of Lyneé Lewis Gaillet, PhD

ABSTRACT

When the Accreditation board for Engineering and Technology (ABET) implemented Engineering Criteria 2000 (EC2000), the new accreditation criteria prompted a distinct shift in technical writing pedagogy, specifically in technical communication classes at universities that require technical writing classes as part of their engineering curriculum. The changes in technical writing classes were made primarily in response to criterion g of ABET's Criteria for Accrediting Engineering Programs: graduating student must possess "an ability to communicate effectively," especially since engineering curriculum often require a single technical writing class to meet the needs of criterion g.

This study explores the connection between the technical writing classroom and professional engineering to determine how well technical writing classes prepare engineers for the writing demands of their future careers and to identify changes that can be made to better prepare students for their future jobs. Data was collected from instructors of technical writing classes to determine the instructors' views of the time engineers spend reading and writing specific documents, the types of documents instructors require in their classes, and the criterion used for evaluation. The findings indicate that overall, instructors have a clear understanding of the reading and writing requirements of professional engineers. However, the study also finds that instructors do not require assignments that parallel professional engineering requirements. To help better prepare engineering students for the writing requirements of their selected profession, instructors should work to find sample documents that parallel professional engineering and should incorporate reading and analysis of those documents in technical writing classes.

INDEX WORDS: Technical Writing, Engineering, Workplace Application, Writing Skills, Composition, Rhetoric

COMPOSITION ASSIGNMENTS WITH WORKPLACE RELEVANCE: AN EXAMINATION OF TECHNICAL COMMUNICATION COURSEWORK AND THE READING AND WRITING DEMANDS OF PROFESSIONAL ENGINEERS

by

ANN MARIE FRANCIS

A Dissertation Submitted in Partial Fulfillment of the Requirements for the Degree of

Doctor of Philosophy

in the College of Arts and Sciences

Georgia State University

2016

COMPOSITION ASSIGNMENTS WITH WORKPLACE RELEVANCE: AN EXAMINATION OF TECHNICAL COMMUNICATION COURSEWORK AND THE READING AND WRITING DEMANDS OF PROFESSIONAL ENGINEERS

by

ANN MARIE FRANCIS

Committee Chair: Lyneé Lewis Gaillet

Committee: Ashley Holmes

George Pullman

Electronic Version Approved:

Office of Graduate Studies

College of Arts and Sciences

Georgia State University

May 2016

DEDICATION

To my family. My husband, Lynn, my daughter, Jessica, and my son, Michael.

ACKNOWLEDGEMENTS

It would be virtually impossible for me to acknowledge everyone who supported me along this journey. While I am grateful to all my family, friends, and colleagues who offered encouragement and guidance, there are some who deserve a special acknowledgement.

First, I must express my deepest gratitude to my dissertation director, Lyneé Lewis Gaillet for her countless support, guidance, patience, and encouragement. I first met Lyneé in a coffee shop when she agreed to discuss Georgia State's rhetoric and composition program. At that point, I knew we would work well together, but I had no idea that over next few years, she would move from a supportive mentor to a trusted friend. She provided extraordinarily fast replies to my countless questions and created a positive learning environment. Her support and encouragement gave me the confidence to present my ideas at conferences and submit articles for publication. From providing constructive feedback on drafts to listening when life fell apart, Lyneé was there.

I also must thank my committee members Ashely Holmes and George Pullman. Both read drafts and answered endless questions, but they also did much more. Ashley inspired me to challenge my teaching methods and use service learning in my technical writing class. While not a direct part of this dissertation, her guidance led to my first ATTW conference presentation. And George, who loves to ask those "pain in the ass philosophical questions," constantly made me think on a level that both challenged me and motivated me to dig deeper. Together, my entire committee helped me become a better scholar, educator, and person. And for that I am forever grateful.

Beyond my committee, I had constant support from my family. My husband, Lynn, was my number one cheerleader, and when he wasn't offering emotional support, he was making sure

I had quiet time to work. He took over cooking for the family (and we quickly learned he is a much better than cook than I am!), he helped with laundry, and he often took the kids out for the afternoon so I could write. I can't thank him enough. And our children, Jessica and Michael, were also amazing, from the first day of classes when they provided advice on what school supplies I needed until the dissertation defense when they woke up early on their own to wish me good luck before I left the house.

Finally, I must thank the person who planted the idea for this dissertation many years ago. Dr. Terry McConathy taught me freshman composition my first semester of college at Louisiana Tech University. And when, several quarters later, I wanted to take an introduction to technical writing course, she quickly offered to overload her class so I could have a seat. After that class I immediately changed my major to technical writing. I was lucky to have the opportunity to take several classes under her, both as an undergraduate and a graduate student, and each time, I learned more about technical writing, teaching, and life. Dr. McConathy was a major influence in my career and my dissertation, and I am eternally grateful to her.

While many say that the PhD process is isolating and depressing, I had the opposite experience. I was blessed to have constant love and support. I am – and forever will be – grateful for the people who supported me during this journey. And I will do my best to pay it forward in honor of all who made this dissertation possible.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

PREFACE

As I moved to the dissertation stage of my PhD journey, I was challenged to find a topic that both interested me personally and was relevant to the world of rhetoric and composition. I considered many different topics, from service learning to digital pedagogy, but I was consistently drawn back to technical writing. I took a technical writing class as an undergraduate at Louisiana Tech University and immediately knew I had finally found my niche after trying several degrees that were not meant for me. After earning a bachelor's degree in technical writing, I stayed to work on a master's degree. During that time, I was first exposed to teaching and was immediately hooked. I loved being in the classroom and helping others learn the wonder of words and how to use those words to communicate clearly. After graduation, I put the technical writing degree to use as a technical writer, a career that gave me incredible experience connecting with engineers and working to help them express their ideas clearly and write effectively for various audiences.

When I started teaching at the University of North Georgia many years later, I was fortunate to be given the opportunity to teach an introduction to technical writing course. And since UNG is part of the Regents Engineering Transfer Program, a program that allows students to take the first two years of coursework with us and then transfer to Georgia Tech to complete their engineering degrees, many of the students taking the technical writing classes were future engineers. In addition, the university offers a dual degree program, which allows students who spend three years at UNG and then two years with an affiliated school and graduate with two bachelor's degrees: an engineering degree from Georgia Tech, Mercer, or Clemson and complementary degree from UNG. Although I was not at a school that offered bachelor's degrees in engineering, I was still exposed to engineering students and was working to teach those students better writing skills.

Those students renewed my interest in the writing of professional engineers and motivated me to continue my studies in an effort to better prepare students for the writing demands of their future careers. Yet, as I started to research technical communication pedagogy, I found minimal research, especially when compared to other areas of rhetoric/composition that my fellow students and colleagues were exploring. The more I delved into pedagogical research in the technical communication classroom, the more areas I found that I wanted to explore. But when I received an email from a former student sharing that his supervisors continually commented on how well he wrote and how seldom they met an engineer who could write so well, I knew I had found the focus of my dissertation research.

1 TECHNICAL COMMUNICATION PEDAGOGY IN ENGINEERING SCHOOLS: PAST TO PRESENT

In 1862 the U.S. Congress transformed higher education by passing the Morrill College Act, formally named "An Act Donating Public Lands to the Several States and Territories which may provide Colleges for the Benefit of Agriculture and the Mechanic Arts." The act provided 30,000 acres of federal land to each state in the union with the stipulation that the land would be sold and all proceeds of the sale would be used to help fund public universities with "at least one college where the leading object shall be...to teach such branches of learning as are related to agriculture and the mechanic arts [today's engineering]…in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions in life" (Library of Congress). The passing of that act resulted in 106 land-grant universities, most of which are public institutions. More important than the number of universities formed is the impact those institutions had on higher education. Prior to the Morrill Act, post-secondary education focused on the liberal arts and was primarily limited to white, wealthy male students who took classes in philosophy, law, or medicine; the industrial class of the time period was excluded from higher education. After the Morrill Act, however, higher education was opened to the industrial class, including people who worked in trade positions or on farms. The Morrill Act was instrumental in forming colleges that provided educational training for the working class, primarily in agriculture and engineering.

One goal of the Morrill Act was to provide functional career skills for the general public, most of whom were farmers and mechanics, and meet "the applied agricultural needs of students by addressing both the theory and practice of agricultural and mechanical arts and sciences" and "making college curricula both accessible and relevant to the industrial class" (Parr, Trexler, Khanna, and Batisti 524). This type of postsecondary education "gave engineering education a distinctive purpose beyond book-learning" by teaching applicable skills and technologies that were overlooked in other university curricula (Nienkamp 315). Land-grant universities originally focused on teaching practical skills but soon realized that students were learning with the single goal of completing a task instead of understanding the scientific philosophy behind the task, a realization that prompted the universities to include more scientific theory in their curricula. And the approach proved successful for the institutions; by 1900, the majority of mechanical and civil engineers in the country were graduates of land-grant universities (Nienkamp 316). Even though the land-grant universities were making a positive impact on engineering professionals, the start of the 20th century found the universities continuing to focus their curriculum on science, math, and technical skills and providing engineers with the necessary technical skills for their future professions while limiting students' exposure to non-STEM classes.

In an effort to ensure the schools were producing quality engineers, the Engineers' Council for Professional Development (ECPD) was formed in 1932 to focus on "the education, accreditation, regulation, and professional development of engineering professionals and students in the United States" (ABET, *History*); the organization's mission, "to establish training plans for personal and professional development, devise methods whereby engineers could achieve recognition from their profession and the public, recognize engineering curricula that met specific standards and maintain a list of accredited curricula, and provide guidance for engineering students" (Aldridge and Cryer), quickly led to the organization forming policies for the accreditation of engineering programs. The organization evaluated its first engineering program in 1936, and by 1947, ECPD had evaluated 580 undergraduate engineering programs at 133 universities. The continued role as the accrediting agency for engineering schools prompted

ECPD to change its name to Accreditation Board for Engineering and Technology (ABET, *History*) in 1980 to better reflect the mission of the organization. While ABET continued to take distinct steps to ensure the land-grant universities were teaching the necessary professional skills, engineering students were still receiving limited education in areas outside of engineering, math, and science.

Today's engineering schools still emphasize technical skills, resulting in a limit of the number of non-STEM (science, technology, engineering, and mathematics) classes engineering students are required to take, especially as technology continues to change and become more complex. As additional technical training is added to the curriculum, other classes that don't fall under the STEM umbrella are removed. The technical proficiencies being emphasized by schools are essential, and still today, the industry appreciates that new engineers have the necessary technical skills, but it was also notes that the new graduates lack the ability to communicate well, a skill that is desired in entry-level engineers and required for those wanting to move into upper-level positions (Todd and Magleby; Prados, Peterson, and Lattuca). It is not just the industry that notes the need for engineers to become better communicators. Engineering faculty and administration, most of whom were also engineers, have made public statements that engineering education is not properly preparing students to work in professional settings (Prados, Peterson, and Lattuca). Many even called for the formation of a new accreditation agency to ensure students were obtaining the skills needed to be successful in the profession. In 1992, individuals from major engineering schools, including University of Michigan, MIT, and Georgia Tech University, banded together to meet with the ABET to share their concerns.

Obviously the idea that engineers were graduating without the necessary skills to be successful in their careers troubled ABET and prompted the agency to change accreditation requirements for engineering, science, and technology programs. The old requirements considered measurable outputs such as faculty/student ratios and course offerings; the requirements were drastically changed with the implementation of new guidelines, referred to as EC2000[1], which consider student outcomes and preparation for job demands. While the list of new requirements includes eleven distinct outcomes to parallel the desired skills of engineering professionals, this dissertation will focus on criterion g: "an ability to communicate effectively" (ABET, *Criteria for Accrediting Engineering Programs*), specifically written communication.

The new criteria for accreditation requirements prompted a distinct shift in technical writing pedagogy. EC2000 served as a catalyst for that change, especially in technical communication classes at universities that required technical writing classes as part of their engineering curriculum. Julia Williams was the first to assert that the new ABET certification requirements would force changes in technical writing programs at universities that offer engineering degrees ("Transformations in Technical Communication Pedagogy"). She noted that while it is easy for technical communication instructors to see the new requirements as affecting only engineering departments, the changes should instead be seen as an opportunity for "both engineering and technical communication faculty to re-fashion their curricula" (150). She specifically called for changes that would allow students to see the connection between their academic work and their future professional careers, something the industry had been saying for years. Essentially, Williams reiterated what Johnson-Eilola had pushed for technical writing instructors to do five years earlier: connect the assignments to the students' future educational and career goals and make the work relevant for more than just a classroom assignment. Only this time, the challenge was shifting due to an accreditation requirement for a department that was not the English Department, which is where technical communication programs are typically

[1] Engineering Criteria 2000

housed. Regardless of the reason, the changes caused departments to reevaluate their approaches to teaching written communication to engineers and make changes to help improve the engineers' writing skills.

1.1 Approaches Taken By Schools

Since Williams first charged technical communication instructors to require course assignments that more directly reflect the workplace environment, considerable research has been done exploring the pedagogy used in technical communication classes. New techniques and approaches have been considered, tried, and reviewed, including curriculum design and revision of technical writing courses, interdisciplinary writing, Writing Across the Curriculum (WAC), and portfolios. These techniques are not new; rhetoric and composition scholars were debating the usefulness of these different approaches in composition classrooms years before ABET decided to implement changes, and that composition research has always naturally extended to technical communication. However, there was a shift in how the changes were being evaluated; now the changes were being studied to determine how well they help engineering departments meet the new accreditation requirements instead of focusing on how well students learn the necessary course outcomes.

1.1.1 Technical Communication Courses

Traditionally, engineering programs teach written communication through technical communication courses. A study by Laura Reave found that 44 of the 73 programs surveyed (60.27%) required engineering students to take a technical communication course, and that course is usually mandated to help students learn proper communication skills for their future careers. Although it is popular for engineering curricula to require at least one technical communication course, the engineering departments are not always the department to house the technical communication programs. Reave noted that of the programs she reviewed requiring technical communication courses for engineering students, more than half had technical communication courses that were offered through the engineering colleges, while 41% of the programs had students take technical communication courses that were housed in departments other than engineering, typically English. Reave's research is not consistent with other studies that show that the majority of technical communication courses are taught by faculty outside of engineering, including a study conducted by Yeats and Thompson that looked at the technical communication programs at 127 institutions and found that the majority, 63.8%, were housed in their school's English department.

The location of the technical communication programs, which may seem insignificant to some, is important because it affects the impact the class has on the engineering students. One distinction between technical communication courses that are offered in engineering departments and those offered by other departments is the demographic makeup of the students enrolled. The technical communication courses that are based in engineering departments have primarily engineering majors enrolled while those in English departments, for example, have a variety of majors. Having students with all the same major can be advantageous, especially when the course is the only class that students take to learn the fundamentals of communication skills necessary their field. Classes that are comprised of students with the same major are able to incorporate projects that directly relate to students' future careers; in a class with all engineering majors, the instructor can assign engineering proposals, technical reports, management reports, and correspondence, all of which are representative of writing the students will do when they graduate. This approach can be especially beneficial since studies have shown that students learn better when they are given assignments that they see relevant to their majors (Buzzi, Grimes, and Rolls).

Single-major technical communication classes, however, do pose problems, especially considering that one of the communication challenges professional engineers face is communicating with those outside of their field and explaining technical concepts to non-engineers (Downing). When technical communication courses are limited to only engineering students, the classes do not reflect a professional engineering setting, where not all engineering writing teams consist solely of professional engineers (Gimenez and Thondhlana). Because the technical communication classes provide one of the few opportunities that engineering students have to learn technical writing skills with non-engineering majors, limiting the classes to only engineering majors can prove disadvantageous; technical communication courses with a variety of majors, on the other hand, provide one of the few opportunities engineering students have to work with non-engineers to produce technical documentation as part of a team project. Universities have noted the need for students to be able to work well with others in and outside of their field, and they are working to provide options in their programs that allow engineering majors to work with non-engineering majors.

To help bridge the gap between engineers and non-engineers and to help meet the additional EC2000 student outcome d, "an ability to function on multidisciplinary teams" (ABET, *Criteria for Accrediting Engineering Programs*), many schools are incorporating collaborative projects into their technical writing classes, a practice that works best when the technical communication classes are housed outside of the engineering colleges and include students with a variety of majors. These collaborative writing projects require students to cooperate with people with different backgrounds, knowledge, and experiences to produce a unified document, a task that helps students learn to work with a variety of backgrounds and skill levels. Gary Randolph, who studied how the Writing Across the Curriculum approach can be used when teaching team writing assignments, found that collaborative writing projects do more than just improve communication skills and prepare students for future professional team projects; he also discovered that collaborative work is an effective learning technique for all learning styles and can help all students master the course content, and he encourages using the approach to teach engineers communication skills.

Gimenez and Thondhlana also studied collaborative writing, but they began their research by looking at how engineers learn to write and the types of writing that professional engineers perform to see if they could draw parallels between on-the-job writing and academic writing. They found that much of the writing in professional engineering requires a variety of experiences and backgrounds that no single engineer possesses and that would work extremely well with interdisciplinary teams. To best emulate the professional environment in which engineers produce written communication, they suggest using the stratified-division version of the parallel writing model for collaborative engineering projects. This approach, which allows each member of the group to contribute based on his or her strengths and to work on his or her portion of the project at the same time as other team members are working on their portions, closely parallels professional engineering projects and provides students with practical experiences that can be utilized in their future careers.

In addition to using collaborative assignments in their technical communication courses, some schools are changing the way they teach technical communication courses by creating a common syllabus and using the same textbook to help ensure each class meets set objectives. Other schools are changing their technical communication courses by deviating from the traditional assignments and requiring varied assignments that they feel more closely represent real-world communication including proposals, manuals, and emails. Still others, such as San José State University's (SJSU) College of Engineering, are adapting the course to include content that both interests the students and helps improve communication skills. SJSU requires all students to take a themed engineering communication class. Students study environmental issues while producing documents typically used in an engineer's professional life including emails, incident reports, feasibility studies, and proposals. At the end of the course, students must pass a timed essay exam to demonstrate they have mastered the basic technical writing skills used in professional engineering; students who do not pass the exit exam must retake the course. In addition SJSU offers a remedial technical communication class for all students who do not pass the exit exam and all nonnative English speakers. These extra efforts were designed in response to local engineering firms expressing concern about the limited written communication skills SJSU's engineering graduates obtained while in school (Linsdell and Anagnos). Northern Illinois University also works with area professionals to help prepare students for their future careers. The school has partnered with the Chicago-area Society of Technical Communication (STC) to offer classes that are team-taught by faculty and experienced technical communication professionals. The classes, while not typically for college credit, provide applicable experience for advanced students, as well as professionals and university faculty, providing a unique combination of academics and real-world experiences (Abbot).

A similar approach to working with professional engineers or technical writers is to build a service learning component, which requires students to work with community organizations as part of the course requirement, in technical communication class design. The research for community-based writing in composition courses is favorable. Service learning has been shown to enhance students' understanding of course concepts and provide motivation for students to produce higher quality work; in addition, it enriches academic relations with the community and broadens students' experiences by exposing them to situations outside of the academy (Deans). The inclusion of service learning projects in technical communication classes is not exactly new. University of Delaware instructors have been using service learning in their technical communication classes since the mid-1980s, as has Judith Kaufman at Eastern Washington University (Huckin). However, the community-based pedagogical approach has seen a surge in technical communication classes since EC2000 was adopted. One reason may be the connection to workplace writing. Bourelle asserts that service learning assignments work well for technical communication classes because they "can provide interaction with new discourse communities outside of academia and therefore contribute to the social interaction that shapes writing, there are lessons that the classroom simply cannot provide" (184). McKee studied the use of service learning in technical writing classes at and concluded that technical communication course objectives work well for the inclusion of service learning components.

1.1.2 Interdisciplinary Approaches

Although technical communication classes have been the standard for teaching engineers to write, there are some concerns with limiting communication requirements to the technical writing classroom. Meloncon and England found that most service technical communication courses were not only housed outside of engineering departments, but they were also taught by contingent faculty. According to their research 83% of technical and professional communication service courses are taught by part-time or non-tenure-track faculty. While some attest that contingent faculty bring in professional experience allowing for a classroom that is more similar to the professional world (Meloncon and England), others agree with R. Eric

Landrum that the constraints part-time faculty face result in lower quality instruction. For engineering departments, the location of technical communication programs and the faculty teaching introductory technical communication courses are especially relevant considering ABET's requirement of effective communication for accreditation of engineering schools. If the schools rely on technical communication courses to meet the EC2000 communication requirement and those courses are taught by contingent faculty who are housed outside of the engineering departments, the schools are depending on sources with limited connection to the engineering department to assist is meeting the requirements for accreditation.

In order to bridge the gap between the two departments, some schools are asking engineering departments to work with English departments to formulate communication classes that utilize the strengths of both sets of faculty. Măgdoiu, Rada, Păcală, and Abrudan Caciora assert that there are benefits of moving beyond the engineering departments to teach their engineers how to communicate. Their research indicates that finding the common intersections between disciplines allows educators to produce interdisciplinary approaches that parallel professional jobs. Ravesteijn, De Graaff, and Kroesen agree and claim that engineering classes are not the best environment for students to learn communication skills; rather those skills are better obtained when humanities and technical classes are integrated and real-life problems are presented.

One of the challenges that faculty encounter when creating interdisciplinary curricula is fusing multiple disciplines into one course or curriculum. Richter and Paretti note that interdisciplinary efforts require more than just combining the content from two or more disciplines; the processes, practices, and approaches must be combined in a true interdisciplinary course. Borrego and Newswander found engineers are often tempted to divide the labor among the members of the group and let everyone do his or her own part, which is the same process that many students, both engineering majors and students from other disciplines, attempt when completing collaborative academic projects. While that approach appears to work well in professional engineering settings and in student collaborative projects, Borrego and Newswander conclude that it is not effective for engineering education and does not meet the goals of true interdisciplinary work. When faculty from engineering departments work with faculty from other departments, it is essential that everyone works together and helps form an environment that is engaging for both content areas and that provides a unified learning environment. Interdisciplinary work benefits more than just the students. Faculty who are able to engage in meaningful interdisciplinary work find the experience beneficial and see it as an opportunity to broaden the learning experience for themselves and their students.

University of Michigan (U-M) is one of many schools taking an interdisciplinary approach to teaching communication skills to engineers. U-M realized that the industry requires different skills of their engineers today than when the U-M engineering curriculum was originally designed and wanted to meet those changing needs. The school, considering the professional skills new engineers need and the diversity of its student body, made significant changes to its mechanical engineering curriculum by adding three integrated courses in design and manufacturing that emphasize, among other things, communication and teamwork. The integrated courses were designed to incorporate more than the typical engineering instruction; the broader reach of the class instruction uses engineering concepts as the backbone of each course but works to help students develop communication, teamwork, and problem solving skills. After studying U-M's changes, Tryggvason, Thouless, Dutta, Ceccio, and Tilbury concluded that although the new curriculum "does not, perhaps, offer the flexibility originally envisioned by the MEAM Undergraduate Curriculum Review Committee" (443), it does provide benefits to the students including increased overall skills, a more diverse background, and the ability for students to more easily pursue dual degrees.

1.1.3 Writing Across the Curriculum

In addition to incorporating interdisciplinary approaches into curricula and having engineering students learn writing skills in specific writing courses, some schools are adopting the Writing Across the Curriculum (WAC) methodology. WAC has become a familiar way for schools to improve students' writing skills at many schools, not just engineering schools, but as engineering schools worked to meet the new ABET requirements, they increased their use of WAC. The approach requires faculty to incorporate writing into classes that have not traditionally included a writing component and students to write in different disciplines instead of limiting writing to English courses. Many experts recommend using the WAC approach to improve students' writing and communication skills in general (Buzzi, Grimes, and Rolls; Williams), but Gary Randolph notes that the approach can be especially beneficial in fields like engineering that are less about learning facts and more about applying concepts. One reason Randolph supports WAC for engineering programs is that the approach can be designed to encompass each of Kobl's learning styles. In an effort to illustrate the usefulness of WAC in an engineering classroom, Randolph designed sample activities that are applicable to engineering students and that complement each learning style, observing that "writing can thus involve both reflection and experimentation, both abstract concepts and the application of those concepts to a concrete example" (Randolph 119) In addition, he notes that WAC is an excellent tool for helping students obtain the higher levels of Bloom's taxonomy, which in turn suggests that WAC would help students develop communication skills that they could apply when they start their engineering careers.

Randolph is one of several researchers who highlight the value of WAC for engineering students. After Buzzi, Grimes, and Rolls studied how engineers learn to write and considered that engineering students respond best to courses and subjects that they see applicable to the future professional jobs, they formulated a WAC approach designed specifically for engineering students. While outlining the different document types and possible topics for each year of the engineering students' time in their undergraduate program, the authors note that "each year should see the production of a set of documents targeting each course … and the inclusion of 'writing' in the marking rubric for written assessments" (483). Julia Williams, who studied the effect of EC2000 on engineering programs, also supports WAC for engineering students. She notes that it is essential for students to be given the opportunity to develop written communication skills in a variety of courses, both technical and non-technical ("Transformations in Technical Communication").

Massachusetts Institute of Technology is one school that uses a WAC approach in the engineering curriculum. Beginning with the freshman class that started in 2001, students enrolled in any of the engineering programs at MIT are required to complete four communication-intensive classes: two in the humanities, arts, and social sciences and two in the student's major (Poe, Lerner, and Craig). In order to help students learn to be effective writers, the emphasis on writing cannot be downplayed in any of the communication-intensive courses. The school requires that at least 20% of the communication-intensive class grade be based on writing ability; even engineering classes that do not fall under the communication-intensive classes category must have a minimum of 20% of the final grade derive from the students' writing (Perelman).

West Virginia University also uses the WAC approach, but the school incorporates Writing to Learn (WTL) techniques by requiring students to maintain an engineer's log. The engineer's log is essentially a journal that is comprised of both directed entries and open entries. Maharaj and Banta explain that the students are required to write weekly open discussions in the log outlining their thoughts on the class, problems they are having, study notes, or anything else that relates to the class. The open discussions are a minor part of the engineer's log; the students must also complete specific assignments for the log including chapter summaries, analogies, explanations, and word problems. While the logs are not graded on the students' writing ability or grammar skills, they are graded on the student's ability to analyze technical concepts with different approaches and provide descriptions of their processes, thereby reinforcing their communication skills. Although Maharaj and Banata's research did not produce statistical evidence, they note that anecdotal testimony indicates that students found the engineer's log applicable to their future goals and beneficial in improving their overall written communication skills.

1.1.4 Portfolios

While the engineer's logs are used to keep students' compositions from multiple classes, the logs are limited in the different types of writing that appear in the log. Portfolios, on the other hand, offer samples of various types of writing over the course of a student's time at the school. Traditionally, portfolios are used in composition courses to encourage students to think of writing as a process and not an event; however, portfolios are beginning to appear in engineering programs to help enhance communication skills and fulfill part of the ABET requirements for accreditation. One thing that engineering departments considering portfolios need to realize is that special attention must be made to make sure the portfolios are designed to enhance the education of the engineering student. Although some schools are tempted to ask students to provide a grouping of past writing assignments, the portfolio should be designed specifically for engineering education. Julia Williams provides five principles upon which engineering portfolios should be based:

- Defining engineering communication (or any other learning objective)
- Identifying appropriate skills and mapping them in the curriculum where they are currently (or should be) developed
- Correlating portfolio learning objectives to course and program objectives
- Facilitating opportunities for students to reflect on their learning
- Assessing student learning so that students, faculty, and programs can benefit and improve ("The Engineering Communication Portfolio").

When used correctly, Martha Ostheimer and Edward White argue, the portfolio provides advantages that are not found in other communication teaching approaches. One benefit they see with the use of portfolios is the ability to include documents prepared over several semesters and for a variety of purposes. The breadth of writing samples included provides a more complete representation of the students' abilities. In addition, the portfolio requires the students to evaluate their own work, a process which serves to use metacognitive skills and helps students apply the lessons they have learned. Ostheimer and White also note that the portfolios provide faculty with details of each student's writing ability, and this information can be used to help assess how well the program is meeting its desired outcomes. As schools work to improve the communication skills of their engineering graduates, the portfolios can serve as a record of the graduates' communication skill levels.

Different approaches have been used when incorporating portfolios in engineering schools. A common approach is to have students create a unique portfolio that illustrates their learning. At Rose-Hulman Institute of Technology, students create electronic portfolios that include assignments they believe clearly illustrate that they have met each of their nine learning objectives. In addition, the students must write an explanation illustrating how each objective was met. The portfolios don't follow the traditional format used in composition courses, but they do require students to demonstrate their writing ability and communication skills along with other soft skills. In addition, the portfolios require students to evaluate their learning process and communicate how they perceive their skills have improved (Williams "Transformations in Technical Communication Pedagogy").

Preliminary results show that the use of portfolios in engineering departments provides several benefits to both the students and the departments. The portfolios allow for data collection over a period of time and provide the ability to compare students' skills. They also provide a chance for students to review their own learning process and their strengths and weaknesses and then apply that new knowledge to their own writing and assignments. While there are many benefits, the transition to portfolios has not proven to be painless for professors or students. Faculty dislike the extra work associated with portfolios, and unlike the engineer's logs, students don't fully grasp how the portfolios help them learn the course objectives, which can lead to frustrated students who see the work as busy work (Williams "The Engineering Communication Portfolio").

1.2 Results from EC2000

As a whole, engineering programs worked diligently to meet the new ABET accreditation criteria, including the requirement to improve students' ability to communicate; three-quarters of the programs surveyed reported a moderate or significant increase in the emphasis on communication (Lattuca, Terenzini, and Volkwein). Although curriculum and pedagogical changes have been made at most engineering schools, the real question is whether or not the changes are producing the desired results. Five years after ABET adopted the new accreditation standards, the agency hired the Center for the Study of Higher Education at Pennsylvania State University to conduct a three-and-a-half year study to determine the effectiveness of EC2000. The researchers solicited information from administrators, faculty, employers, and graduates (pre- and post-EC2000) to answer one primary question: "Are engineers who graduated from programs since implementation of the EC2000 standards better prepared for careers in engineering than their counterparts who graduated before introduction of the criteria?" (Prados, Peterson, and Lattuca). The findings of the study indicated that the changes implemented by schools in response to EC2000 had positive effects in all areas of the new accreditation requirements, including criterion g: "an ability to communicate effectively" (ABET, *Criteria for Accrediting Engineering Programs*). The students' self-reported ranking of communication skills indicated improvement compared to pre-EC2000 levels, although the improvement was not as strong as most of the other areas, moving from an adjusted mean score of 3.74 to 3.97 (on a 5-point scale) (Lattuca, Terenzini, and Volkwein). Although some question the use of self-reporting studies, ABET notes that "when self-reports are aggregated to compare to the performance of groups, they are generally considered to be valid measurements of skills under study" (Lattuca, Terenzini, and Volkwein 6). Even with the concern over self-reports, the results of the research on the effectiveness of EC2000's learning outcome g are positive; there has been improvement, which was ABET's original purpose for implementing EC2000.

While ABET touts the study as a strong indicator of the effectiveness of EC2000 and asserts that "the pre- to post-EC2000 changes in program curricula, practices, and policies … are positively related at statistically significant, if sometimes small-to-moderate, levels even after taking other factors into account" (Lattuca, Terenzini, and Volkwein p. 9), others note that the changes have not been significant. Wayne Whiteman looked at the curricula of 20 mechanical engineering programs before EC2000 and again after those schools were accredited under the new standards. After reviewing three studies that took place over a 20-year period, he concluded that there were only minor variations in the curriculums over the 20 years with the exception of two "small noticeable trends" (193) including slight increases in the amount of math required and the choices in elective classes. Obviously, neither of those trends relate to communication or work to improve the communication skills of the students.

Even if some consider the changes in curriculum slight, an increased emphasis on communication in the engineering curriculum has been seen in recent years, and many, including Prados, Peterson, and Lattuca believe that EC2000 served as the catalyst for that change. Some even maintain that the increased emphasis appears to have helped students improve their communication skills. However, there are still complaints that entry-level engineers are not better communicators than those who graduated pre-EC2000, and the complaints are not coming solely from the industry. One study done by Sageev and Romanowski found that recent graduates of engineering programs felt their technical communication classes did not adequately prepare them for their professional jobs. But they also note that communication skills, both oral and written, are essential to their careers. Darling and Dannels analyzed curriculum changes in the University of Utah's Department of Engineering to consider how different pedagogical approaches impact students' communication skills. In addition, they collected data from engineering alumni to consider the role that communication skills play in professional engineering. The researchers concluded that engineers lack the necessary communication skills upon graduation and emphasized that engineers are spending more time communicating in their jobs than they did in the past, yet their communication skills are not improving. Research supports the assertion that engineers need to be able to communicate in their profession; multiple studies conducted since ABET adopted the new accreditation standards show that strong communication skills are still essential for engineers to be effective in their job at all levels and especially to receive promotions to upper-level positions (Ravesteijn, de Graaff, and Kroesen; Lappalainen; Darling and Dannels). Even with the changes in engineering curricula, it is evident that engineers are not graduating with the skills they need to be successful communicators in the field. Because of the divide between the communication skills that the profession requires and the skills that engineers have, engineering schools are still being pushed to produce graduates with better communication skills (Kassim and Ali; Ravesteijn, de Graaff, and Kroesen).

As a matter-of-fact, research continues to show that engineering graduates still do not feel they are adequately prepared and do not possess the necessary writing skills to be effective their jobs (Kassim and Ali; Steiner). Not only do they lack the necessary skills, but they also report that they spend up to half the time at work writing (Smelser), a point that makes the lack of writing skills even more troublesome for the engineers, especially since written communication skills are desired for all entry-level engineers and required for any engineer who wants to move to upper-level engineering positions (Magleby, Sorensen, and Todd; Prados, Peterson, and Lattuca). Professional engineers agree that writing is important in their occupation and note that engineers would benefit from more training, with 40% of the respondents asserting that more emphasis in college engineering programs should be put on professional written communication skills (Smelser).

1.3 Research Justification

Although scholars and industry experts agree that engineering graduates need stronger writing skills, the engineering curricula tend to emphasize technical skills focusing on math, science, and technology, leaving little room for additional courses that are not seen as directly relevant to the field of engineering. As noted earlier, most schools require engineering students to take a single technical communication class to learn the writing skills needed for their future profession and as the primary way to meet criterion g of EC2000. Since the majority of technical communication classes are housed in English departments (Yeats and Thompson), it is likely that the faculty teaching the engineers to write have never held a position in engineering or have first-hand knowledge of the writing requirements for engineers, making it difficult for those faculty to create assignments that match what is required on the job. As Thomas Orr noted years before EC2000, "unless both student and teacher have sufficient knowledge of the unique purposes and characteristics of English as it is used in a student's target field of study, writing instruction will be no different from that in general English courses, and thus, less effective in enabling students to successfully carry out profession-related tasks" (2). The English faculty do not have a clear understanding of the type of writing in professional engineering settings; they struggle just to agree on what type of writing engineering students should be able to produce upon graduation (Plumb and Scott). This disconnect is leaving the students at a disadvantage as they are graduating without the necessary skills to be successful in their chosen careers.

It is important to note that the studies on individual technical communication classes often included more than just engineering students. While the studies were usually linked back to meeting EC2000 requirements, criteria designed specifically for engineering, science and technology programs, the students in most of the studies were not limited to the population EC2000 was designed for. This gap in the research is both logical and difficult to overcome. As Reave found, most engineering programs require at least one technical communication class for their students to help meet EC2000 criterion g, but those classes are not restricted to engineering students. So the research incorporates other majors, including students assumed to have fairly strong writing skills, such as English majors. In addition, the faculty teaching the technical communication classes should be considered. Yeats and Thompson looked at 142 universities and found that most technical communication classes are taught by English faculty, not engineering faculty, even though engineering majors often make the majority of the students in the classes (in schools that offer engineering degrees).

The biggest issue with the current research is that it does not fully explore the connection to the workplace. In 2001 Williams charged instructors of technical communication classes to make the classes relate to the students' future careers ("Transformations in Technical Communication Pedagogy"). That charge was repeated in 2009 by Lappalainen who, after studying the communication demands of professional engineers, found that although many engineering graduates strive to move to management positions, positions that require strong communication skills, those students feel that communication training is an unnecessary distraction; it isn't until after the students are working that they realize the disadvantages of minimal communication training. With these findings, he asserts that universities must make changes by "bringing together academic research knowledge with the corporate reality" and "match the quality and content of the course supply with industrial needs" (128). But there is no current research comparing what is taught in the classroom and what is required in the workplace.

Cunningham and Stewart recently examined the writing that engineers and architects do and their perceptions of the importance of writing in their careers. They have provided essential research on the views that engineers hold regarding writing and the amount and types of writing done by professional engineers. Their study must serve as the start of an important discussion, one that must continue if we are to best serve the needs of our students and match our pedagogical approaches to the demands in the professional workplace. As the researchers note, "An ethnographic study is needed to assess post-secondary educators' perceptions of writing quality and how it may be affected by pedagogical influence" (10). This research project moves the conversation forward works to ensure we are properly preparing engineering students for their future careers.

2 RESEARCH PLAN AND METHODOLOGY

As I started to consider ideas for my research project, I considered various avenues related to technical writing, but I was always drawn back to one specific area: how well technical writing classes prepare engineering students for their future careers. This research topic appealed to me for several reasons, especially since I have worked with professional engineers who claim they can't write and future engineers who claim there is no need to learn writing skills as engineering students. The primary reason the topic appealed to me is the research. I have heard for years that engineers don't write well and when I reviewed the research, I quickly found that it supports that conclusion. And if technical writing classes are the primary means for teaching communication skills to future engineers, it seems logical that instructors of technical writing classes should be aware of the communication demands that professional engineers face. For how can an instructor meet the primary goal of teaching engineering students the skills necessary to communicate in their field if the instructor is not aware of the communication requirements specific to the field of engineering?

Once I determined the need for research that considers how well instructors of technical writing, technical communication, and professional writing prepare students for the reading and writing demands of professional engineering, I worked to create a research plan. I knew that most engineering programs require students to take a technical writing class as a requirement for the engineering degree, and I was also aware that a single technical writing course was often the primary requirement schools used to help teach engineering students the written communication skills to meet ABET accreditation requirements. As a result, I focused my research on the perceptions that instructors have of the reading and writing engineers do in their professional careers, how well those perceptions match the actual requirements of professional engineers, and whether the assignments and evaluation standards in technical writing, technical communication, and professional writing classes match the reading and writing requirements of professional engineers.

To study how well technical communication assignments meet the demands of professional engineers, I designed a quantitative and qualitative research study. The quantitative research study paralleled Cunningham and Stewart's research project that studied the time engineers spend writing specific types of documentation. My study was designed to collect data on instructors' perceptions regarding the time engineers spend reading and writing in their professional careers, specifically looking at the time that instructors believe engineers spend reading and writing correspondence (letters, email, memos, and faxes), meeting minutes, technical reports, management reports, proposals, and manuals. This research data was then compared to the data collected by Cunningham and Stewart to determine how closely the instructors' perceptions of the time engineers spend reading and writing matches what engineers report.

In addition to considering perceptions of time spent reading and writing, the quantitative survey also was used collect data on assignments instructors require for students in technical communication classes and the evaluation of those assignments. The study asked instructors how heavily they weigh both reading and writing specific types of documents (again, correspondence, meeting minutes, technical reports, management reports, proposals, and manuals) in their classes and what criterion they use for evaluation of written work in technical writing classes. I compared the data I gathered from the instructors to the data Cunningham and Stewart collected from engineers to determine how well the requirements in technical communication classes match the demands of professional engineering.

The quantitative data was supplemented with qualitative data that I collected, specifically sample syllabi, rubrics, and assignments prompts. Participants in the survey had the option to supply sample documents, which were used to identify trends in assignment types and evaluation criterion. Again, this data was compared to the data supplied by the engineers, but it was also compared to the quantitative data supplied by the instructors to determine how well their survey responses match what the documents provided indicate that instructors actually emphasize in the classroom.

Because the survey was geared towards instructors of technical communication, technical writing, and professional writing, the participants for the survey were solicited through the Association of Teachers of Technical Writers (ATTW) listserv, a listserv that is comprised primarily of instructors of technical writing but also has some active participants who do not teach technical writing but have related interests, such as technical communication professionals and graduate students. A total of 62 instructors completed the survey, all of whom have taught at least one technical writing, technical communication, or professional writing course in the past two years. The instructors provided data on their views of the types of reading and writing professional engineers do, their reading and writing assignment requirements for their courses, and their views of the necessary characteristics for effective writing. In addition, some participants provided sample syllabi, assignment prompts, and rubrics, although submitting the documents was not necessary to participate. Those who did not submit documents still provided valuable input for the quantitative portion of the research study.

2.1 Purpose of the Study

To formulate a thorough analysis of the correlation between written communication skills of engineers and technical writing, professional writing, and technical communication classes, I knew I needed to consider both the engineers' views and the instructors'. The engineers would provide valuable insight on the writing and reading requirements of their profession, and the instructors would be instrumental when considering course elements and course design currently being used in the technical communication classroom. Fortunately, Cunningham and Stewart recently conducted an eight-month research project in which they surveyed over 100 engineers in seven different states to "research and analysis of perceptions of time spent by architects and professional engineers on reading, writing, and evaluating various information products, as well as their perspectives of the importance of these activities in meeting work goals" (2). The data from their study "Perceptions and Practices: A Survey of Professional Engineers and Architects," which was published in the *International Scholarly Research Network*, provides valuable information on how engineers spend their time. It isn't an analysis of what others say engineers do; instead it is a survey of the engineers themselves.

I wanted to take the same approach in my research as I worked to analyze the effectiveness of current pedagogical practices in the technical communication classroom, so I designed a research project to collect data directly from college instructors of technical writing, technical communication, and professional writing classes. The research project focused on three specific areas from the instructors' perspective: the time engineers spend reading and writing specific documents, the importance of each type of document in engineering, and the criterion for effective writing. I then compared the data I collected to data on the engineers' perceptions on the same topics as collected by Cunningham and Stewart, which allowed me to determine two critical elements: how well instructors of technical communication understand the reading and writing requirements of professional engineers and if engineers and instructors identify the same characteristics when determining the effectiveness of written communication. This information helped me evaluate how well technical writing instructors are preparing engineering students for their future careers.

In addition to doing quantitative research on the perceptions of both engineers and instructors, I also wanted to do qualitative research to determine if the instructors' survey responses match their classroom expectations. To obtain data for the qualitative research, I asked participants to submit sample syllabi, assignment prompts, and rubrics. The syllabi and assignment prompts were used to help me determine if the assignments given to technical writing students match the writing requirements of professional engineers, and the rubrics helped determine how instructors evaluate effective writing. The evaluation of effective writing is an important consideration when identifying gaps between the views of the instructors and the views of the engineers. Specifically, when I analyzed the writing assignments required in technical communication classes geared towards engineers and how those assignments are evaluated, I was able to make an assertion as to the effectiveness of the written communication skills being taught to engineering students.

2.2 Research Questions

With the primary goal of determining how well technical communication classes prepare engineering students for writing in professional engineering jobs, I focused on the following four research questions:

1. How well do instructors’ perceptions of reading and writing requirements of professional engineers match the actual reading and writing requirements of professional engineers?
2. How well do the reading and writing assignments required in technical communication classes duplicate the reading and writing requirements of professional engineers?
3. What characteristics do technical communication instructors look for in quality writing?
4. How well do those characteristics match the characteristics engineers define as necessary for quality writing?

2.3 Survey Creation

As I worked to design my research project, I decided to construct the survey for this research project using the design and format of Cunningham and Stewart’s 2012 survey that explored the writing demands of professional engineering. The researchers from Radford University surveyed engineers and architects in an effort to determine how much time the professionals spend writing and reading in their careers, how much time they spend evaluating specific types of documents, how important they believe those tasks (reading specific documents, writing specific documents, and evaluating writing) are to their careers, and what characteristics they look for in effective writing. Although the survey was designed for and given to both engineers and architects, only 6% of the respondents indicated they were professional architects. Since the vast majority of Cunningham and Stewart's survey participants were engineers, the survey gives a good overall representation of the types of writing engineers do in their careers, how that writing affects their jobs, and what characteristics engineers look for when evaluating writing.

Cunningham and Stewart's survey focused on three specific areas: the time engineers spend reading and writing in their professional careers, the importance of both reading and writing for their success as engineers, and what characteristics engineers look for in quality writing. My survey was designed to research the same three areas, but instead of surveying engineers, I worked to gather data on the instructors' viewpoints, specifically instructors of technical writing, technical communication, and professional writing. Because my goal was to compare data from this study and Cunningham and Stewart's study, I used their survey format and questions as the foundation when I created my plan for collecting data; the parallel format provided an effective comparison of the views of the instructors and the engineers. I revised Cunningham and Stewart's questions to make my survey applicable to instructors and to determine instructors' perceptions of the reading and writing required of professional engineers and instructors' views of characteristics of effective technical communication. The similarity of the format and questions allowed for the instructors' viewpoints and the engineers' to be considered side-by-side to identify trends and discrepancies in each individual group and between the two groups.

The first area that my survey explored was the instructors' perceptions of the amount of time engineers spend reading and writing specific types of documents in their professional careers. This section was designed to provide data that could be compared to the question in Cunningham and Stewart's survey that asked engineers to indicate how often their job involves both reading and writing the following types of documents: correspondence (letters, email, memos, and faxes), meeting minutes, technical reports, management reports, proposals, and manuals. I wanted to determine if the instructors have a clear understanding of the time that engineers spend reading and writing in their professional jobs, and this question will provide a direct comparison of what the instructors believe engineers do on the job and what engineers report they actually do.

I approached this portion of my research in the same manner as Cunningham and Stewart. I created a survey that asked instructors how much time they believe professional engineers spend reading and writing each type of document that Cunningham and Stewart included on their survey: correspondence (letters, email, memos, and faxes), meeting minutes, technical reports, management reports, proposals, and manuals. Just like Cunningham and Stewart, I gave participants six choices for each task when responding: Very Rarely, Rarely, Neutral, Often, Very Often, or N/A; the parallel response choices allowed me the opportunity to study the results from the instructors who participate in my survey and the engineers in Cunningham and Stewart's survey side-by-side. In addition to providing a basis for comparison, the questions in this section are designed to provide foundational information on the perceptions that technical writing instructors have regarding the time engineers spend reading and writing while on the job, which helped answer my first research question: how well do the instructors' perceptions of writing requirements of professional engineers match the actual requirements of professional engineers?

Similarly, I included a section of the survey to determine the importance instructors give to various types of documents in their classes. I asked instructors to consider how heavily they weigh both reading and writing the same types of documents listed above (correspondence, meeting minutes, technical reports, management reports, proposals, and manuals) in their technical communication classes. Again, participants were given six options when responding: Very Little, Little, Neutral, Heavily, Very Heavily, or N/A, just as the engineers in Cunningham and Stewart's survey were given. This set of questions is important because it provides details about the types of writing emphasized in technical writing classes. Again, the question was designed to be evaluated in conjunction with Cunningham and Stewart's data from engineers which asked what how often engineers spend writing each of the types of documents. The question will allowed to determine if the assignments, both reading assignments and writing assignments, given in technical writing classes match the documents engineers are required to read and write in their careers and was used to help answer my second research question: How well do the assignments in technical writing duplicate the writing requirements of professional engineers?

The final section of the quantitative portion of my survey again included questions based on Cunningham and Stewart's study; however, this time the survey did not consider what types of reading and writing engineers do or the time engineers spend reading and writing specific documents. Instead, the survey shifted to the evaluation of writing. Cunningham and Stewart worked to determine what engineers look for when they evaluate writing, both their own writing and the writing of fellow professional engineers, and I wanted to explore how well the instructors' definition of quality technical writing matched the engineers'. To collect the data from the engineers, Cunningham and Stewart had participants use a five-point scale (Very Trivial, Trivial, Neutral, Crucial, or Very Crucial) to rate the importance the following statements in their professional writing:

- Technical documents should cover topic with appropriate and proper detail
- Technical documents should use precise language to express meaning
- Technical documents should provide a true understanding and representation of the subject
- Technical documents should be grammatically correct
- Technical documents should describe information's importance and implications

I incorporated this question into the survey by asking instructors of technical writing, technical communication, or professional writing to rate each criteria using the same options as Cunningham and Stewart provided. Again, the information from my study was designed to parallel Cunningham and Stewart's study to provide a side-by-side comparison and determine how well the instructors' views of the necessary components of effective writing match the engineers' views. The comparison helped answer the last two research questions for this project: what characteristics do technical communication instructors look for in quality writing? How well do those characteristics match the characteristics engineers define as necessary for quality writing?

In addition to the quantitative questions that paralleled the Cunningham and Stewart study, I also incorporated qualitative questions into the survey to further explore the research questions posed. Participants were invited to upload sample syllabi, assignment prompts, and rubrics. The sample syllabi were used to determine what assignments instructors require in their technical communication classes and how much each assignment is weighed when calculating the final course grade. While the survey already had questions asking instructors how they weigh specific documents in their class, the syllabi provided different information. The assignments listed on the syllabi were not limited to the types of documents from Cunningham and Stewart's study; instead the syllabi provided an overview of all the assignments required for the technical writing classes, so I was able to see what assignments instructors require that are not on the quantitative survey. With this data, I worked to identify any trends in the assignment requirements in technical writing classes that would not be visible in the quantitative survey results.

Similarly, I collected sample assignment prompts and sample rubrics to identify data that would not stand out in the survey results. Specifically, I reviewed the assignment prompts and rubrics to identify characteristics instructors look for when evaluating technical writing assignments. Although the instructors were asked this information when they completed the survey, their responses were again limited to the characteristics listed for the question. The sample assignment prompts and rubrics were used to identify characteristics that the instructors view as important whey they are designing course materials. These documents were not limited in the way that the quantitative questions are, especially since the instructors wrote the assignment prompts and rubrics prior to taking my survey and with the sole purpose of outlining their requirements for the students. It is important to note that while the instructors were invited to provide sample syllabi, assignment prompts, and rubrics, the survey clearly indicated that choosing not to upload sample documents would not affect the survey or lessen the usefulness of the respondent's participation.

The survey also asked quantitative demographic questions that were not related to the research questions, but were asked to obtain additional data for possible cross tabulation. The demographic questions were related to the respondents' job and education, including the participants' title/rank, highest level of education, the discipline of their highest degree, information about their institution, and if the institution awards engineering degrees. The demographic questions were optional; survey participants had the option not to respond to the demographic questions and still submit a usable survey. Each survey participant was asked the following demographic questions:

- What is your job title?
- What is your highest level of education?
- What is the discipline of your highest degree?
- At what type of institution do you teach?
- Is the institution public or private?
- Does your college or university offer engineering degrees?
- Do you teach classes in the United States?

I had to add a few additional questions before the survey was complete. Because the survey dealt with human subjects, I was required to obtain IRB approval. As a result, the first question on the survey asked each participant to agree to an informed consent (see Appendix A), as required per IRB regulations. Participants were required to agree to the informed consent before starting the survey. Unlike the demographic questions, agreeing to the informed consent was not optional. If a participant did not agree to the informed consent, he or she could not continue with the survey; instead the survey would end and participants would be thanked for their interest in the study. Participants were also asked to answer questions to verify that they were eligible to participate before continuing with the survey. Respondents were asked to confirm that they agree to participate in a study and that they have taught at least one technical communication class in the past two years.

A complete copy of the survey can be found in Appendix B.

2.4 Data Collection

Before I could send the survey to potential participants, I had to get IRB approval through Georgia State University, which was granted on September 29, 2015. Once I had approval, I was authorized to send surveys and collect data. To create and distribute the survey, I used Qualtrics Survey Software, a powerful software platform that allows researchers to send surveys to specific audiences and collect the data while participants remain anonymous. When considering what software to use to distribute the survey, the deciding factor was the ability for participants to upload documents as part of the survey. Since I wanted to collect sample syllabi, assignment prompts, and rubrics in addition to getting quantitative survey data, it was essential that the survey software I used would allow participants to anonymously upload files. Qualtrics allowed file uploads, kept survey responses anonymous, and provided an online link to access the survey. The software met all the needs I had for this project, so I designed the survey using Qualtrics software.

Once the survey was created using Qualtrics, the next steps were to distribute the survey and collect data. When determining how to distribute the survey, I first had to consider the intended audience. The survey was designed for post-secondary instructors of technical communication, technical writing, or professional writing classes, which led me to ATTW (Association of Teachers of Technical Writing). The ATTW community focuses on technical communication, is a well-known organization that has been in existence for over 40 years, and is a popular place for instructors to exchange ideas related to teaching technical writing. It also has a strong following, with approximately 1,000 members ("History ATTW"), including professional technical communicators and students and instructors of technical writing. The listserv, which at the time had 248 members (Bradley, Dilger, personal communication, November 20, 2015), is identified as the most effective way to distribute information to ATTW members and, consequently, served as the perfect avenue for distributing the survey to potential participants.

Before sending the survey to the ATTW listserv, I beta tested the survey by sending an active copy of the survey to six colleagues and asked them to review the survey and provide feedback. They all agreed and provided valuable feedback. The suggestions they made were related to the formatting and the pagination of the survey, which I adjusted to make the survey more aesthetically pleasing. In addition, they provided feedback on the tables and asked that the tables be adjusted to fit on one screen. Again, I took their suggestions and made adjustments to the survey, and then tested it on different computers and using different operating systems to ensure that it was formatted appropriately in all situations. I also ran the survey on mobile devices to check compatibility on phones and tablets. Although all the participants provided feedback and recommendations for changes, none made suggestions related to the wording of the questions or the survey content.

After beta testing was complete, I was ready to activate the survey and solicit participants. I cleared all responses submitted during beta testing in anticipation of collecting data to be used in the research study. The official data collection began on Friday, October 16, 2015, when I activated the survey and sent an email to the ATTW listserv; the email explained the purpose of the study, outlined the format of the survey, asked for listserv members to participate in the study, and included a link to the survey (see Appendix C.1 for a copy of the original email). Thirty-seven listserv members clicked the survey link that was provided in the October 16 email. Two and a half weeks later, on November 3, 2015, I sent a second email reminding the listserv members about the survey and inviting ATTW members who had not participated to do so. I also included a copy of the original email that outlined the study's purpose (a copy of the second email can be found in Appendix C.2). Twenty-four listserv members clicked the link from the email sent on November 3 and started the survey. On November 16, I sent a final email to the ATTW listserv thanking everyone who had already participated and encouraging those who had not participated but were eligible to follow the link and complete the survey; again, the original email was forwarded as part of the message (see Appendix C.3 for a copy of the email). That email resulted in ten additional surveys being completed. The survey was closed on November 18, 2015, just over one month after it was opened.

2.5 Data Classification and Coding

The data for this research project falls into two distinct classifications: quantitative and qualitative. The quantitative portion of the study includes demographic information, including participants' level of education, discipline of their highest degree, academic rank, and affiliation. More importantly it explored the instructors' perceptions of the writing and reading requirements of professional engineers and the instructors' assignment requirements in their technical communication, technical writing, and professional writing classes. Since I was measuring attitudes and perceptions, I used a Likert scale, which provides numerical data that could be analyzed to calculate the mean, average, range, and relative frequency distribution for each question. The Likert scale also provided a consistent platform, consistent with Cunningham and

Stewart's study for future comparison and consistent for all the instructors who chose to participate in the survey.

For the first two non-demographic survey questions (How much time do engineers spend doing the following tasks in their professional jobs? How heavily are the following activities/assignments weighed in your technical communication classes?), participants were giving five choices that were used for tabulation: Very Rarely, Rarely, Neutral, Often, and Very Often. Each response was assigned a score from one to five, with each Very Rarely earning a score of one and Very Often a score of five. The third quantitative question (How important are the following characteristics weighed when you grade assignments from your technical writing classes?) also had five choices including Very Trivial, Trivial, Neutral, Crucial, and Very Crucial. Again, each response earned a score between one and five when the results were tabulated; Very Trivial was given a score of one and Very Crucial was given a score of five. Participants also had the option to choose N/A for all questions; any N/A responses were discarded from analysis.

Although the quantitative research would provide valuable statistical data, I also wanted to incorporate qualitative research to explore how well the instructors' perceptions indicated by the survey question responses are represented in their course documents. The qualitative research includes evaluation of course syllabi, assignment prompts, and rubrics, which participants provided at the end of the survey. While I gave all participants the option to submit sample documents, I clearly indicated that uploading documents was voluntary and would not affect the usefulness of the quantitative responses. Before analyzing the documents for the study, I read each syllabus, assignment prompt, and rubric any information that could identify the participant. I deleted or blacked out any details including the instructor's name, school, address, email, phone, and/or office location before the document was assigned a random number and saved for use in the research study.

2.5.1 Syllabi and Comprehensive Assignment Prompts

The first documents that I evaluated were the sample syllabi. A total of 20 syllabi were provided by survey participants. I reviewed each syllabus to determine how the syllabi outlined what assignments were required for course completion Five syllabi gave no details or descriptions for the required course assignments; instead they labeled assignments with generic terms that left it impossible to determine how to classify each assignment ("Writing Assignment #1" or "Major Writing Assignments"). Those syllabi were not included in the analysis, resulting in fifteen syllabi used for data analysis. In addition to syllabi, two participants uploaded assignment prompt packets that included all the assignments for the class, the weight of each assignment for final grade calculation, and descriptions of the assignments; these assignment prompts are referred to as *comprehensive assignment prompts*. I included those comprehensive assignment prompts with the syllabi when I analyzed the assignment requirements in technical communication classes. While they were not technically syllabi, the documents did contain the required assignments for the course and the weight of each assignment, the exact information I needed for this part of the study, so it made sense to include them in the analysis along with the syllabi.

One purpose of having instructors provide sample syllabi, assignment prompts, and rubric was to determine what types of writing technical writing instructors require in their classes. To find this information, I looked to the syllabi and assignment prompts and grouped the assignments according to the reading and writing activities used in both my survey and in Cunningham and Stewart's survey. The surveys looked at reading and writing six specific types of documents: correspondence, meeting minutes, technical reports, management reports, proposals, and manuals. For this study, I categorized all letters, emails, and memos as correspondence, in an effort to follow Cunningham and Stewart survey design since they specifically name letters, emails, and faxes as types of correspondence; memos, while not specifically mentioned in Cunningham and Stewart's survey, are an older variation of email with the same basic components and same basic formatting, so I categorized memos as correspondence for the purpose of this study.

The biggest challenge with the classification of assignments listed on the syllabi and comprehensive assignment prompts was determining how to group different types of reports. Cunningham and Stewarts's survey included two types of reports, management reports and technical reports, but did not provide any explanation of the difference. Although I emailed Cunningham (the correspondence author) looking for clarification, those emails were not answered. Since none of the syllabi and comprehensive assignment prompts provide in this study used the term "management report" and only one used the term "technical report," I had to determine how to differentiate the two types of reports and how to categorize assignments that were listed on the sample syllabi and comprehensive assignment prompts but had different names, such as recommendation reports. In order to do that, I contacted five engineers who work for different companies and asked each how they would differentiate technical reports and management reports.

The overall opinions from the engineers I contacted were the same: management reports are high level while technical reports provide implementation details that can be replicated. Mark Stevens simply explained that management reports "analyze productivity and profitability" (personal communication, January 2, 2016). When asked about progress reports, Mark Farren elaborated, “Management reports give progress without enough details to replicate the work. I can’t think of a progress report that would be detailed enough for a technical report.” (personal communication, December 30, 2105). Based on their replies, progress reports, recommendation reports, reports to decision makers, and usability test reports were classified as management reports, while technical reports, analytical process analysis reports, and implementation reports were grouped as technical reports.

Locating assignments that would be classified as manuals was not as difficult. Although none of the syllabi and comprehensive assignment prompts included the term *manual*, several assignments were classified as manuals for the purpose of this study. I grouped both technical instructions and procedures as manuals because the assignments asked students to create documents similar to manuals, such as outlining the steps to complete the task or providing instructions. While all the engineers I contacted about technical versus management reports noted that technical reports are often designed to include implementation details and enough information so the work can be duplicated, they also stressed that technical reports did not stop with the instructions. Technical reports also include “project specific issues…such as cost, population at risk, etc” (Joe Monroe, personal communication, January 2, 2016). The assignments that were identified as manuals did not incorporate the extra elements that would classify them as technical reports but rather focused on the step-by-step instructions to complete a task or build a project.

The final two types of documentation were the easiest to identify on the syllabi and comprehensive assignment prompts. The first type, proposals, was straightforward. Since several instructors used the term *proposal* on their syllabi and comprehensive assignment prompts, there was little question about how to group the assignments. Any assignment named a proposal on the syllabi and comprehensive assignment prompt was classified as proposals for data analysis. There were no assignments that did not include the term *proposal* that were included as proposals for the purpose of this study. In addition, there were no syllabi or comprehensive assignment prompts that indicated the instructors require meeting minutes as part of the course requirements. Nor were there any assignments that resembled meeting minutes, such as note taking. Some instructors required journal entries, but they were reflective assignments that did not resemble taking minutes during a formal meeting, so they did not match the genre of meeting minutes.

In addition to the assignment types already discussed, several instructors also asked their students to complete assignments that were not included as one of the types of documentation listed in the quantitative portion of this study. Most of the additional assignments fell into one of two categories: employment materials and evaluation assignments. Anything related to obtaining a job was categorized as employment materials, including cover letters, job application packets, resumes, employment packets, and interview appreciation letters. Assignments that called for students to evaluate the work of another student, a professional writer, or themselves was included as an evaluation assignment. Analyzing descriptions and genres, reviewing peer work, reflecting on personal work, and critiquing published documents all require students to consider various types of writing and determine what specific elements made the work effective or ineffective. As a result, the assignments are considered evaluation assignments for the purpose of this study.

2.5.2 Rubrics

While most of the assignment classification were straightforward, it was not as easy to code the rubrics for several reasons. The primary reason being that there was a greater variation of terms on the rubrics and many of those terms had no details to explain the instructors' expectations, unlike the assignments that often provided the assignment name and outlined enough specifics so I could determine how to classify them. Consequently, I approached the coding of the rubrics a little differently. I started by creating a master list of all criteria listed on each rubric, at which point it became apparent that I was not going to be able to classify the rubric criteria based on Cunningham and Stewart's evaluation criteria. Their criteria were detailed and did not provide the broad evaluation themes that I needed for the study. Instead, I organized the standards according to the attributes outlined by the Analytic Writing Continuum (cited by Bang):

(a) Content (central theme or topic, quality and clarity of ideas and meaning);

(b) Structure (logical arrangement, coherence, and unity);

(c) Stance (perspective communicated through level of formality, style, and tone appropriate for the audience and purpose);

(d) Sentence Fluency (rhetorical features, rhythm, and flow crafted to serve the purpose of writing);

(e) Diction (Precision and appropriateness of the words and expressions for the writing task); and

(f) Conventions (usage, punctuation, spelling, capitalization, paragraphing).

For each Analytic Writing Continuum criterion, I identified key words that represent the criterion. I then used those key words to determine how to classify each evaluation statement on the master list. For the first criterion, Content, I included measures that mentioned the words *content*, *clarity*, *clear*, *details*, *support*, *evidence*, and *justification*. These words, which focus on the information being provided, how well that information was explained, and what evidence and support was provided, directly deal with the content of the assignment as outlined by Band and the Analytic Writing Continuum. The rubric criteria that were incorporated under Content include, but are not limited, to the following statements (a complete list can be found in Appendix D. 1):

- You identify the project with enough clarity and detail for the readers to visualize the site
- Content is accurate, comprehensive, relevant, and supported claims
- Document contains relevant information
- Connects the problem to similar problems identified in a survey of literature, using multiple forms of detailed, appropriate, and well-documented evidence
- Includes complexity of thought as well as credible and numerous sources of information
- Clear statement of what information the message contains and why it is important

For the second Analytic Writing Continuum criterion, Structure, I included assignment standards that had the words *logic*, *organization*, *structure*, *unity*, *understand*, *organization*, *headings*, and *concise.* All the words are fit for the Analytic Writing Continuum's definition of structure, which focuses on arrangement, coherence, and unity (Bang). I included evaluation criteria related to headings since the purpose of headings is to help organize information and create an effective structure, which makes the headings appropriate for the Structure criterion. Sample criteria that were classified as structure statements include the following (see Appendix D. 2 for complete list):

- Arranges parts logically
- Follows structural conventions for the genre

- Sustains main idea through a logical progression of supporting points
- Information is "chunked" in ways that make sense
- Briefly outlines the plan and suggests the organization of the rest of this document
- Technical writing makes use of appropriate heading, lists (where appropriate), and transitions

The third criterion on Analytic Writing Continuum's list is Stance, which Bang identifies as "perceptive communicate through level of formality, style, and tone appropriate for the audience and purpose." Evaluation measures that had words including *audience*, *voice*, *tone*, *purpose*, *professional*, and *appeals* were included in the Stance category based on Bang's description of Stance which focused on the tone of the work, understanding the audience, and using the appropriate appeals in writing. The following evaluation standards were identified as Stance criteria (refer to Appendix D. 3 for a complete list):

- Excellent match of level of formality and technically to audience
- The wording and style are unlikely to confuse or intimidate non-expert readers
- Takes care of the readers
- Uses active voice (unless passive voice is necessary)
- Uses professional tone/language
- Writer appears knowledgeable

For the fourth criterion, Sentence Fluency, I looked for standards that were related to the sentences and the overall flow of the document. I identified statements that included the following key words: *sentences*, *sentence length*, *transitions*, and *sentence structure*. The following statements are included in the Sentence Fluency criterion (the complete list can be found in Appendix D. 4):

- Sentence length is appropriate
- Concise, coherent, and smooth flowing sentences
- Sentence structure produces clear meaning
- Provides necessary transitions
- Varied sentence structure

The fifth criterion on the Analytic Writing Continuum is Diction, which includes word choice and word usage. For this category, I identified evaluation measures that included the words *prose*, *language*, *terms*, *jargon*, *vocabulary*, *wording*, and *word choice*. The following statements were included as Diction criterion (see Appendix D. 5 for the complete list):

- Clear and succinct prose
- Technical terms, processes, acronyms, and jargon are defined and used appropriately
- Avoids redundancy, ambiguity, and abstract language
- Language is appropriate for the audience (bias-free, gender-neutral, and familiar wording; no slang or clichés)
- Writing should not be monotonous in word choice

The last criterion outlined by the Analytic Writing Continuum is Conventions, which relate to "usage, punctuation, spelling, capitalization, paragraphing" (Bang). The measures included in the category are related to grammar and mechanics, and most of the standards included the word *grammar*. Also included in this category was paragraph length. The following are some of the criterion in this category (a full list can be found in Appendix D. 6):

- No grammatical, mechanical, or typographical errors

- Paragraph length is appropriate
- Paragraphs are appropriately sized
- Document contains few to no distracting composition errors (grammar, mechanics, punctuation, style, or spelling)

In addition, many of the rubrics provided by survey participants contained criterion that were not related to any of the above Analytic Writing Continuum attributes. Those criteria were typically included meeting assignment guidelines, providing proper citations, formatting according to industry standards, and designing the document to be visually appealing. Any evaluation criterion that did not fit one of Analytic Writing Continuum's six attributes was categorized as Other. The Other criteria were then subdivided into three categories: Assignment Requirements, Document Design, and Visuals. When referring to the Other criteria, I identified them by their sub classification with *Other* as a prefix. This approach makes it easy to identify which criterion are not part of the Analytic Writing Continuum attributes of effective academic writing.

Other-Assignment Requirements statements include requirements such as length, submission procedures, deadlines, and citations; anything that is a basic assignment requirement but does not serve to improve the effectiveness of the writing was classified as Other-Assignment Requirements. The Other-Document Design statements focused on the visual appeal of the document. They did not include formatting such as adhering to MLA format, which would fall under Assignment requirement statements; instead, they focused on document design. Assignment criteria that discussed the typography, visual appeal, and document layout were classified as Other-Document Design Statements. The last Other category is Other-Visuals; evaluation criterion in this category include criterion related to pictures, figures, graphs, tables, and charts, such as the placement of graphics, proper use of figures, and the numbering and labeling of any visual aids used in the document. A complete list of the Other-Assignment, Other-Document Design, and Other-Visuals criteria can be found in Appendices D. 7, D. 8, and D. 9, respectively.

Only two of the rubrics included weights for individual criteria; all others were holistic with no indication of how different criterion would affect the final grade. While I hoped to be able to evaluate the instructors' views of the importance of the different criteria based on the weight assigned to each for the specific assignments, it was not possible with only two rubrics that included weights. I did evaluate how often the different Analytic Writing Continuum attributes and the Other criterion were noted on the rubrics, but I was unable to determine which evaluation criteria was more heavily emphasized based on the rubrics provided.

2.6 Limitations

As with any study, this study has limitations that must be addressed. The primary limitation is the variety of types of engineers. The amount of time spent on different writing tasks is partially dictated by the type of engineering being performed. As noted by survey participant Laura Pigozzi, "duties vary widely within engineering disciplines, job descriptions, and companies. Chemical engineering is not equal to civil engineering is not equal to biomedical engineering" (personal email communication, November 4, 2015). Survey participant Robert Irish agreed and noted that "big companies have formal meeting-minutes structures with action items, but start-ups often are writing their notes on scraps of paper or on a tablet; yet both need to understand how to communicate action with responsibility" (personal email communication, October 16, 2015). This limitation was noted by only two of the participants, which could indicate that most instructors are not aware of the differences that the various types of engineering employ or it could simply mean that the instructors did not take the time to send an email regarding their concerns.

Additionally, the question regarding how instructors perceive what writing professional engineers do (or series of questions) prompted a few concerns. Robert Irish had the biggest objection, noting that the questions “worried” him. He continued by explaining, “I have done a significant amount of training of writing teachers at various engineering schools across North America, and frankly, many of them are quite clueless about what engineers both read and write” (personal email communication, October 16, 2015). I noted his concern but also realized that his views were part of the reason for the research: to determine the gap between what instructors perceive and what engineers actually do. Because of the purpose of the study, I was not too concerned about this limitation. And Robert Irish acknowledged that as well: “Perhaps I’m missing the point, and you’re trying to assess perceptions of instructors vs. actual writing in the field. You might get more interesting answers to these questions if you asked engineers rather than writing teachers. But, perhaps you’re doing that too” (personal email communication October 16, 2015). Since I am comparing the results of my survey to the results of Cunningham and Stewart’s study, I don’t see the approach as a strong limitation. I do think, however, that it would be worth making that purpose of the questions a little clearer in future studies to avoid confusion and to avoid people from seeing the initial questions and not completing the survey for fear that the study will not be effective. Also I am not sure that happened, there were some participants who started the survey but failed to complete it, and it is possible that one reason is because of the initial questions regarding the instructors’ view of what writing engineers do in their careers.

3 INSTRUCTORS' PERCEPTIONS OF READING AND WRITING REQUIREMENTS IN PROFESSIONAL ENGINEERING

Once the survey was distributed and data collected, I worked to compile the results. First I reviewed the demographics of the participants. This information allowed me to see an overview of the participants in the survey and to consider how well they matched the needs for the study. Fortunately, all participants had the experience teaching technical writing, technical communication, or professional writing that I was looking for with this survey. The demographic information also provides details on the participants' degree, rank, experience, and type of institution.

When I moved to the survey questions that were designed to help answer my research questions, I first worked to determine the instructors' perceptions of what types of reading and writing engineers do in their professional careers and how much time they spend doing the different types of reading and writing. The data for this portion of the research study was conducted through quantitative survey questions using the Likert scale. This information was instrumental because it would tell me what the instructors think, information that I would use to compare to Cunningham and Stewart's study of engineers and their responses regarding the types of reading and writing they are required to do in their professional careers.

In addition, I considered the assignments that instructors require in their technical writing, technical communication, and professional writing courses. I looked at the types of assignments, how they weigh those assignments when calculating the final course grade, and how the instructors evaluate the assignments. This information came from two different areas of research. Some of the data was part of the quantitative research questions, but I also collected sample syllabi, assignment prompts, and rubrics. The syllabi and assignment prompts were analyzed to determine the importance instructors put on various types of writing in their technical communication, professional writing, or technical writing classes. And the rubrics were used to analyze what criteria instructors use when evaluating student work, information that can be compared to the criteria that engineers use when evaluating their own and other professional engineers' written work.

All the data that is reported in this chapter will be analyzed in the next chapter, where I determine what the results mean by comparing the information to Cunningham and Stewart's research on engineers' perceptions of the reading and writing requirements in their professional engineering jobs.

3.1 Participants

Because my research questions directly related to how instructors perceive and teach engineers to write in technical writing classes, the survey was limited to participants who have taught technical communication, technical writing, or professional writing classes at the post-secondary level in the past two years. The participants were solicited through the ATTW listserv, a listserv dedicated to teachers of technical writing. The survey was sent to all listserv members, and of the 248 listserv members, 71 members started the survey (28.63%). Nine of those participants (12.68%) did not complete more than three questions; their responses were eliminated from data analysis. The remaining 62 surveys were used for analysis, which equates to responses from exactly 25% of the listserv members.

As expected, all respondents indicated that they had taught at least one technical communication, technical writing, or professional writing course in the past two years. Additionally, all but one survey participant teach in the United States, which resulted in no opportunity for cross tabulation based on location of the program. The type of college where the participants teach was more diverse than the locations. Of those 60 respondents who completed the demographic questions, the majority, 47 (78. 33%) teach at a public university that grants graduate degrees, and 12 (20%) teach at a four-year college. Using cross-tabulation, I was able to determine that three respondents (5%) teach at a private, non-profit 4-year college. Only one participant of the 60 (1. 67%) teaches at a two-year college, an organization which is also private, non-profit institution.

The majority of respondents, 52 of 60 (86. 67%), teach at public institutions; only 8 participants (13. 33%) teach at a private, non-profit school. None of the participants reported teaching at a for-profit college or university. While the study did not require that participants teach at a school that offers engineering degrees, I did ask participants if their school offered engineering degrees, and I was pleased to learn that the participants primarily came from schools that offered degrees in engineering. Almost all of the schools represented offer engineering degrees; 56 respondents (93. 33%) specified that their school grants engineering degrees, and only four (6. 67%) indicated their school does not offer any type of engineering degree.

Figure 3.1 illustrates the breakdown of the participants' institutions by type.

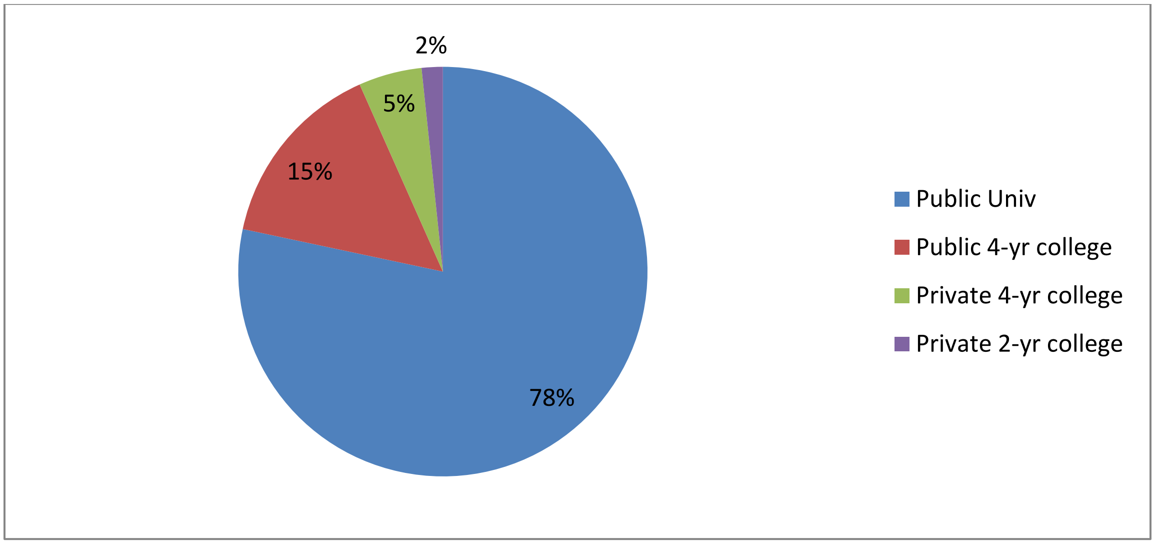

Figure 3.1: Breakdown of Participants' Institutions

Although the majority of participants indicated that they taught at schools with engineering programs, there was not the same consistency in the participants' academic rank. Sixty respondents shared their job title, indicating a variety of academic positions, from adjuncts to full professors. The majority of respondents, 36 participants (60%) were full-time tenured or tenure-track faculty. Within those tenured or tenure-track faculty, the most common academic rank was Associate Professor, with 17 (28. 33%) of the respondents indicating they held that position. Other tenure and tenure-track respondents include 12 (20%) Assistant Professors, 6 (10%) Full Professors, and one (2%) Tenure Track Instructor II. Twenty-four (40%) of the respondents were non-tenure track, including 16 (26. 67%) FT-Non-Tenure-Track instructors, five (8%) Graduate Assistants, and three (5%) adjunct faculty members.

A breakdown of the participants' job title can be found in Figure 3.2.

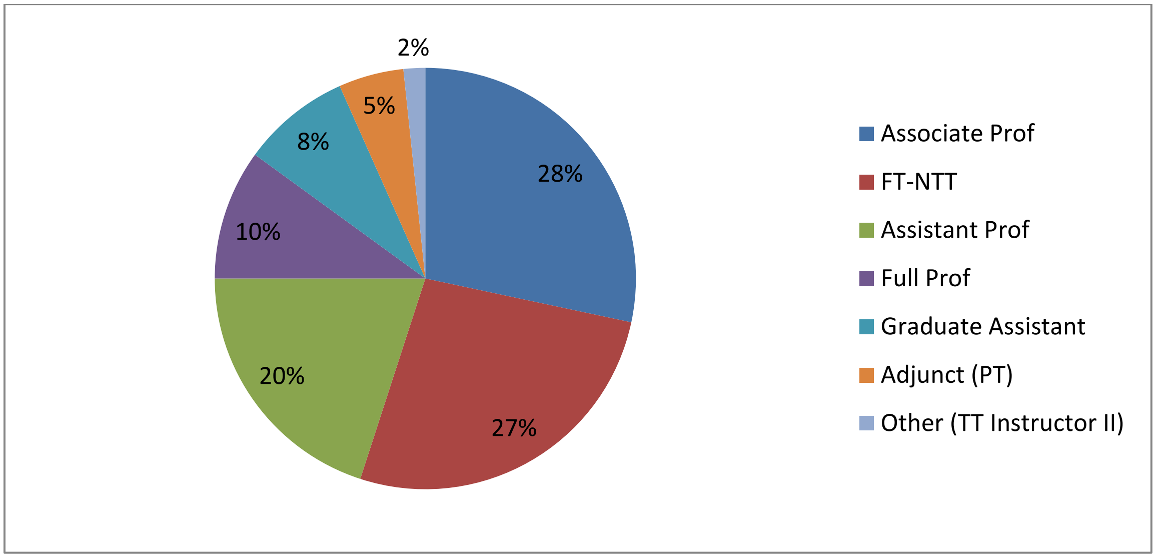

Figure 3.2: Breakdown of Participants' Job Titles

In addition to job titles, the study asked for information on the highest degree participants earned. Again, 60 participants answered the questions related to degrees, and two participants declined to answer. The majority, 46 (76. 67%), held a PhD, while 12 (20%) reported that their highest degree earned was a master's degree. One respondent (1. 67%) had an MFA, and one respondent (1. 67%) selected "other" but did not provide a response when asked to indicate the highest degree.

The discipline of highest degrees earned by participants varied. The two most common disciplines were professional/technical communication and rhetoric/composition. Twenty-two participants (36. 67%) indicated that their highest degree fell into the field of professional or technical communication, and 16 of the participants (26. 67%) held degrees in rhetoric/composition. English degrees were a close third, with 15 respondents (25%) choosing English as their highest degree earned. Four participants (6. 67%) reported their highest degree was in an education-related field, including instructional technology and design, literacy education, and educational psychology. The following disciplines had one respondent (1. 67% for each discipline): communication, engineering, and reading.

A chart representing the degrees held can be found in Figure 3.3.

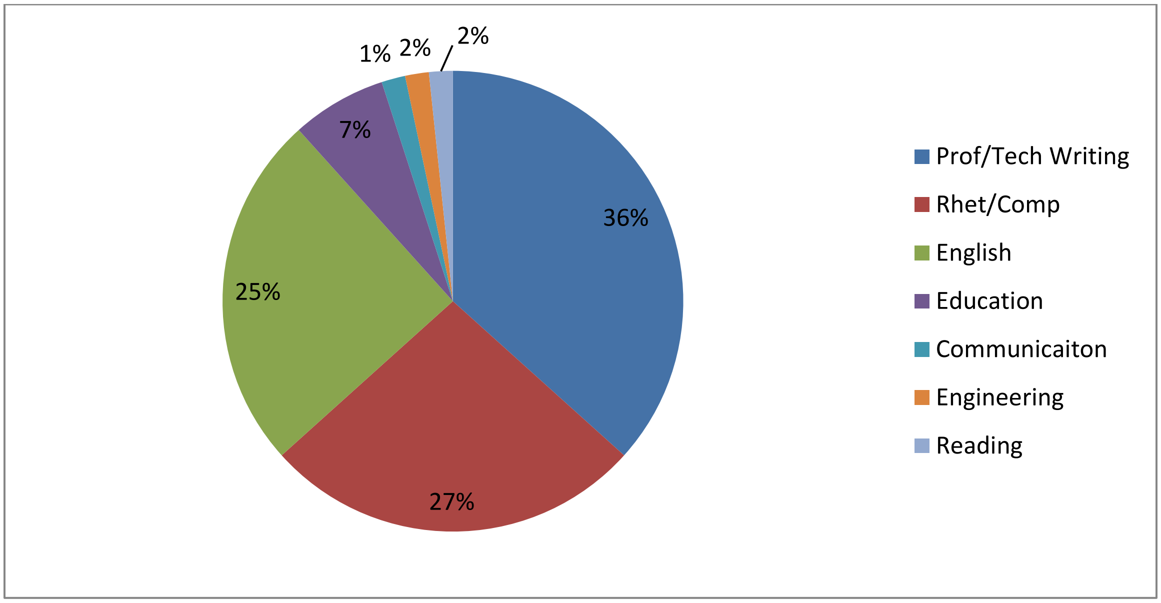

Figure 3.3: Breakdown of Discipline of Participants' Highest Degree

3.2 Reading and Writing in Engineering

To determine instructors' perceptions of the reading and writing engineers do in their professional careers, I asked survey participants how much time they believe engineers spend reading and writing six different types of documents: correspondence (letters, emails, memos, and/or faxes), meeting minutes, technical reports, management reports, proposals, and manuals. I intentionally included those specific documents; I wanted to be able to compare the results to Cunningham and Stewart's study. Participants were given six choices for how often engineers read and write each document type: Very Rarely, Rarely, Neutral, Often, Very Often, or N/A, although no participants selected N/A for any of the document types. The responses were tabulated using a five point scale, with Very Rarely earning a score of one and Very Often receiving a score of five.

In addition, instructors were asked how heavily they weigh both reading and writing in their technical writing, technical communication, or professional writing classes. The survey asked respondents to consider how they weigh correspondence (letters, emails, memos, and/or faxes), meeting minutes, technical reports, management reports, proposals, and manuals when calculating final grades for their technical writing classes. Again, the participants were given six options when responding: Very Little, Little, Neutral, Heavily, Very Heavily, or N/A. No participants selected N/A for any of the questions. When tabulating responses, I assigned Very Little a score of one and Very Heavily a score of five; this scoring method is in line with Cunningham and Stewart's research methods and provides a balanced comparison between the two studies.

3.2.1 Correspondence (letters, emails, memos, faxes)

Overall, instructors of technical and professional writing report that they believe that engineers spend considerable time both reading and writing correspondence. All of the 61 participants who responded indicated that they perceive that engineers read letters, emails, memos, and/or faxes either Often or Very Often. Eighteen respondents (29.5%) believe that engineers Often read correspondence Often, and 43 (70.5%) selected Very Often for how much time engineers spend reading correspondence. The mean score for how much time engineers spend reading correspondence was 4.70.

The results for writing correspondence were similar. Instructors agreed that engineers spend considerable time writing correspondence. Of the 61 respondents who responded, 59 selected either Often (14 responses; 23%) or Very Often (45 responses; 73.8%) when asked how much time they thought engineers spend writing letters, emails, memos and/or faxes. Two participants (3.3%) selected neutral. The mean score for how much time instructors believe engineers spend writing correspondence was 4.70, the same as the mean score for how much time instructors perceive engineers spend reading correspondence.

Table 3.1 outlines the responses instructors provided when asked how much time they believe engineers spend reading and writing correspondence in their professional job.

Table 3.1 How much time do engineers spend reading and writing correspondence in their professional jobs?

Question	Very Rarely	Rarely	Neutral	Often	Very Often	Mean	Responses
Reading Correspondence (letters, emails, memos, faxes)	0	0	0	18	43	4.70	61
Writing Correspondence (letters, emails, memos, faxes)	0	0	2	14	45	4.70	61

While instructors noted the emphasis on both reading and writing correspondence in professional engineering jobs, the activity was not as heavily emphasized in their classes. When asked how much emphasis instructors place on reading correspondence in their classes, the most common response was Heavily, with 25 participants (40.3%) selecting the option, while Very Heavily was selected by six participants (9.7%). However, more than half selected either Neutral (14 participants; 22.6%), Little (14 participants; 22.6%), or Very Little (3 participants; 4.8%). The mean score for the emphasis that instructors place on reading correspondence fell just above Neutral, at 3.27.

The instructors who participated in the study placed more emphasis on writing correspondence than reading correspondence in their professional writing classes, with 46 of 62 respondents (74.2%) indicating either Very Heavily (24 participants; 38.7%) or Heavily (22 participants; 35.5%) when asked how much emphasis they put on writing correspondence in their technical writing classes. Only two participants (3.2%) indicated that they put Very Little emphasis on writing correspondence, and three (4.8%) indicated Little. With 11 participants (17.7%) selecting Neutral, the mean for emphasis instructors put on writing correspondence was 4.02.

Table 3.2 details how instructors responded when asked how heavily reading and writing correspondence are weighed in their technical communication classes.

Table 3.2 How heavily are reading and writing correspondence weighed in your technical communication classes?

Question	Very Little	Little	Neutral	Heavily	Very Heavily	Mean	Responses
Reading Correspondence (letters, emails, memos, faxes)	3	14	14	25	6	3.27	62
Writing Correspondence (letters, emails, memos, faxes)	2	3	11	22	24	4.02	62

Almost two-thirds of the instructors who provided syllabi and comprehensive assignment prompts incorporated some assignment component that included correspondence. Of the seventeen syllabi and comprehensive assignment prompts used for data analysis, eleven (64.7%) had an assignment that included writing a memo, letter, or email for a grade. The average weight of the correspondence assignment was 11.2% of the students' final grade, with a spread of 5% to 25%. The assignments included business letters, reflective memos, and introductory emails; none of the assignments mentioned faxes which was included in Cunningham and Stewart's survey as a type of correspondence.

3.2.2 Meeting Minutes

Instructors of technical writing classes do not perceive meeting minutes as relevant to professional engineers' success as they do other types of communication. Of the 61 participants who responded to the survey question, only 2 (3.3%) indicated that they believe engineers read meeting notes very often, and 12 participants (19.7%) responded Often. The most common response to the question how often do professional engineers read meeting notes was Rarely, with 26 people (42.6%) selecting that option. The second most common answer was Neutral; 18 participants (29.5%) selected Neutral. Only three participants (4.9%) selected Very Rarely. The mean for how often engineers read meeting minutes was just under Neutral at 2.74.

Even fewer instructors believe that engineers write meeting minutes in their professional careers. The majority of survey participants selected either Neutral (22 participants; 36.1%) or Rarely (20 participants; 32.8%) when asked how much time engineers spend writing meeting notes. Nine participants (14.8%) felt that engineers very rarely write meeting minutes. Only 10 of the instructors in the survey indicated that engineers write meeting minutes either often or very often, with eight (13.1%) responding Often and two (3.3%) responding Very Often. The mean score for how often engineers write meeting minutes was 2.57 or Neutral.

The instructors' responses for how much time they believe engineers spend reading and writing meeting minutes in their professional jobs are detailed in Table 3.3.

Table 3.3 How much time do engineers spend reading and writing meeting minutes in their professional jobs?

Question	Very Rarely	Rarely	Neutral	Often	Very Often	Mean	Responses
Reading Meeting Minutes	3	26	18	12	2	2.74	61
Writing Meeting Minutes	9	20	22	8	2	2.57	61

Based on the results above, it makes sense that instructors would not emphasize reading or writing meeting minutes in their technical communication classes. The survey indicates that instructors indeed do limit the emphasis on reading meeting minutes, with only 3 of 58 (5.2%) putting Heavy (1 participant; 1.7%) or Very Heavy (2 participants; 3.4%) emphasis on reading meeting minutes in their professional writing classes. Instead the majority, 33 participants (56.9%) put Very Little emphasis on reading meeting minutes and six participants (10.3%) put Little emphasis. Six respondents (10.3%) responded Neutral to how much emphasis they put on reading meeting minutes in their technical communication classes. The mean response for how much emphasis instructors put on reading meeting minutes was between Very Little and Little at 1.67.

And while fewer instructors responded that they put little to very little emphasis on writing meeting notes in their classes, the numbers were similar. Forty-six of 59 instructors (78%) specified that they put Little (17 participants; 28.8%) to Very Little (29 participants; 49.2%) emphasis on writing meeting notes in their classroom, while only 4 instructors (6.8%) emphasis writing meeting notes either Heavily (2 participants; 3.4%) or Very Heavily (2 participants; 3.4%). Nine instructors selected Neutral for how writing meeting notes was weighed in their technical writing classes. The mean score instructors gave the emphasis on for writing meeting minutes in their technical writing classes was just under Little at 1.83.

Table 3.4 shows the breakdown of the instructors' responses when asked how heavily reading and writing meeting minutes are weighed in their technical communication classes.

Table 3.4 How heavily are the reading and writing meeting minutes weighed in your technical communication classes?

Question	Very Little	Little	Neutral	Heavily	Very Heavily	Mean	Responses
Reading Meeting Minutes	33	16	6	1	2	1.67	58
Writing Meeting Minutes	29	17	9	2	2	1.83	59

Based on the responses given for the quantitative questions about meeting minutes, it makes sense that meeting minutes were not included as an assignment or a component of an assignment in any of the syllabi or comprehensive assignment prompts provided by participants. Nor were meeting minutes mentioned in any of the other documents provided by the instructors who supplied syllabi, rubrics, and/or assignment prompts for the study.

3.2.3 Technical Reports

Technical reports rated much higher than meeting minutes, both in how often engineers read and write technical reports and in how heavily they are weighed in technical writing classes.

No survey participants responded that engineers very rarely read technical reports and only three (4.9%) indicated that engineers rarely read technical reports. Instead, the vast majority, 54 of 61 participants (88.5%) indicated that engineers read technical reports either Often (25 participants; 40.9%) or Very Often (29 participants; 47.5%) in their professional. Four of the 61 instructors (6.6%) responded Neutral. The mean response to how much time instructors believe engineers spend reading technical reports was 4.31, a little more than Often.

Similar responses were given when asked how often engineers write technical reports; none of the instructors believe that engineers Very Rarely write technical reports and only five of 61 respondents (8.2%) believe that engineers Rarely write technical reports. Almost half of the respondents (29 participants, 47.5%) indicated the engineers write technical reports Often, and Very Often was close to Often with 25 instructors (41%) indicating that they feel engineers write technical reports Very Often. Only two instructors (3.3%) responded Neutral. The mean for how often engineers write technical reports was just under the mean for how often they read technical reports; the instructors' mean was closer to Often at 4.21.

Refer to Table 3.5 for an overview of the instructors' responses when asked how much time they believe engineers spend reading and writing technical reports in their professional jobs.

Table 3.5 How much time do engineers spend reading and writing technical reports in their professional jobs?

Question	Very Rarely	Rarely	Neutral	Often	Very Often	Mean	Responses
Reading Technical Reports	0	3	4	25	29	4.31	61
Writing Technical Reports	0	5	2	29	25	4.21	61

With the strong responses that instructors perceive engineers spend considerable time reading and writing technical reports, it comes as no surprise that instructors also emphasize technical reports when they design their professional writing classes; however, they don't emphasize reading technical reports as much as writing. Almost a third of the respondents, 20 of 62 (32.3%) emphasize reading technical reports Heavily and 12 (19.4%) emphasize it Very Heavily. A close second to Heavily was Neutral, which 18 participants (29%) selected. Twelve instructors selected either Little or Very Little, with ten (16.1%) selecting Little and two (3.2%) selecting Very Little. At 3.48, the mean was almost evenly between Neutral and Heavily.

Instructors place more emphasis on writing technical reports in their technical communication classes, with only one instructor (1.6%) putting Very Little emphasis on writing technical reports and none putting Little emphasis. On the contrary, over a third weigh writing technical reports either Heavily (27 participants; 43.5%) or Very Heavily (27 participants; 43.5%). Seven of the 62 respondents (11.3%) were neutral on how much they weigh technical report writing. Overall, instructors gave the writing of technical reports a rating of just over Heavily, with a mean of 4.27.

Table 3.6 provides the breakdown of the instructors' responses when asked how heavily reading and writing technical reports are weighed in their technical communication classes.

Table 3.6 How heavily are reading and writing technical reports weighed in your technical communication classes?

Question	Very Little	Little	Neutral	Heavily	Very Heavily	Mean	Responses
Reading Technical Reports	2	10	18	20	12	3.48	62
Writing Technical Reports	1	0	7	27	27	4.27	62

Technical reports, which included analytical research reports, usability reports, and technical reports, were required as an assignment requirement in almost 25% of the technical communication classes, according to qualitative portion of the survey. Four of the seventeen syllabi and comprehensive assignment prompts (23.5%) required some type of technical report.

These reports had a decent impact of the final grade, with an average weight of the technical reports being 16.2% of the final course grade, with a range of 10% to 25%.

3.2.4 Proposals

When considering how much time engineers spend writing different documents, instructors ranked proposals as third, after writing correspondence and technical reports. The proposals did not rank as high for time spent reading documents, though. In addition to correspondence and technical reports, instructors also felt that engineers spend more time reading management reports than they do reading proposals. Overall, instructors gave reading proposals a mean score of 3.66, with 42 (68.9%) reporting that they believe engineers read proposals either Often (35 participants; 57.4%) or Very Often (7 participants 11.5%). Nine instructors (14.8%) responded that engineers rarely read proposals, and ten (16.4%) selected Neutral. At 3.66, the mean score was between Neutral and Often.

Similarly, most instructors feel that engineers spend considerable time writing proposals; 46 of 61 instructors (75.4%) indicated that engineers write proposals Often (31 participants; 50.8%) or Very Often (15 participants; 24.6%) in their professional careers. Two instructors 3.3%) felt engineers write proposals Very Rarely, and twice as many (4 participants; 6.6%) responded Rarely. Nine instructors who answered the question (14.8%) selected Neutral. A mean of 3.87 was given by instructors of technical writing for the time they believe engineers spend writing proposals.

Refer to Table 3.7 for an overview of the instructors' responses to the question how much time do engineers spend reading and writing proposals in their professional jobs.

Table 3.7 How much time do engineers spend reading and writing proposals in their professional jobs?

Question	Very Rarely	Rarely	Neutral	Often	Very Often	Mean	Responses
Reading Proposals	0	9	10	35	7	3.66	61
Writing Proposals	2	4	9	31	15	3.87	61

Instructors weigh the reading of proposals in their classes more than they do the reading of any other document covered in this survey, with a mean value of 3.61. The majority of respondents (39 participants; 62.9%) indicated that they weigh the reading of proposals either Heavily (26 participants; 41.9%) or Very Heavily (13 participants; 21%). Only eleven instructors (17.7%) responded that they weigh the reading of proposals Very Little (3 participants; 4.8%) or Little (8 participants; 12.9%) in their technical communication classes.

In addition, the writing of proposals is strongly emphasized in technical communication classrooms. Proposal writing is emphasized more than any other type of writing by the technical communication instructors surveyed. Fifty-four of 62 instructors (87.1%) reported that they weigh proposal writing Heavily (24 participants; 38.7%) or Very Heavily (30 participants; 48.4%), with no instructors indicating that they weigh the writing of proposals Very Little in their classes and only four (6.5%) saying that they weigh writing proposals Little and four (6.5%) responding Neutral. The mean for proposal writing in technical communication classes was between 4.29.

Table 3.8 outlines the instructors' responses when asked how heavily they weigh reading and writing proposals in their technical communication classes.

Table 3.8 How heavily are reading and writing proposals weighed in your technical communication classes?

Question	Very Little	Little	Neutral	Heavily	Very Heavily	Mean	Responses
Reading Proposals	3	8	12	26	13	3.61	62
Writing Proposals	0	4	4	24	30	4.29	62

Proposals were the most common assignment in technical writing courses. Of the seventeen syllabi and comprehensive assignment prompts evaluated, thirteen (76.5%) required a proposal as part of the course requirements. Although the proposals were required by more instructors, the proposal assignments were not weighed as heavily as the management reports when calculating the final course grade. While the management reports weighed as much as 60% of the final course grade, proposals averaged only 15.1%, with the highest weight given to a proposal being 30%. The overall spread of the weight for proposal assignments was 5.3% to 30%.

3.2.5 Management Reports

The instructors who participated in the survey reported that they felt engineers spent less time reading and writing management reports than technical reports. Of 61 respondents, 41 (67.2%) indicated that they believe engineers read management reports Often (24 participants; 39.3%) or Very Often (17 participants; 27.9%), while only nine (14.8%) answered Rarely with none Very Rarely. Eleven instructors (18%) responded Neutral. The mean of the instructors' perceptions of how much time engineers spend reading management reports was not quite Often, at 3.8.

The instructors' responses indicate that they feel engineers spend less time writing management reports than reading them, although the responses for times spent writing and reading management reports are very close. Again, nine participants (14.8%) responded that engineers Rarely write management reports and none responded Very Rarely; however, fewer instructors felt that engineers write management reports than read them, with (11 participants; 18%) responding Very Often. The most common response was Often, which almost half of the instructors selected (29 participants; 47.5%), and the second most common answer was Neutral;

twelve of the instructors (19.7%) responded Neutral. The mean for writing management reports is between Neutral and Often but closer to Often at 3.69.

Refer to Table 3.9 for a breakdown of the instructors' responses when asked how much time they believe engineers spend reading and writing management reports in their professional jobs.

Table 3.9 How much time do engineers spend reading and writing management reports in their professional jobs?

Question	Very Rarely	Rarely	Neutral	Often	Very Often	Mean	Responses
Reading Management Reports	0	9	11	24	17	3.80	61
Writing Management Reports	0	9	12	29	11	3.69	61

Even with the perception that engineers spend significant time reading management reports, technical communication instructors do not weigh reading management reports heavily in their classes. Of 61instructors who responded, only 14 (23%) weigh reading management reports either Heavily (9 participants; 14.8%) or Very Heavily (5 participants; 8.2%); conversely, 31 (50.8%) weigh reading management reports Very Little (10 participants; 16.4%) or Little (21 participants; 34.4%). Over a quarter of the respondents responded Neutral when asked how heavily they weigh reading management reports in their technical communication classes. The mean was between Little and Neutral at 2.64.

Interestingly, there is a fairly large spread between how instructors weigh reading management reports and how they weigh writing management reports. Sixty instructors responded to the question asking how heavily they weigh writing management reports; the mean was close to Neutral at 3.14, with Neutral being the option selected most often (18 participants; 30%). Twenty-four respondents (40%) selected either Heavily (15 participants; 25%) or Very

Heavily (9 participants; 15%), and 18 (30%) selected either Little (13 participants; 21.7%) or Very Little (5 participants; 8.3%).

See Table 3.10 for details of the instructors' responses to the question how heavily are reading and writing management reports weighed in your technical communication classes.

Table 3.10 How heavily are reading and writing management reports weighed in your technical communication classes?

Question	Very Little	Little	Neutral	Heavily	Very Heavily	Mean	Responses
Reading Management Reports	10	21	16	9	5	2.64	61
Writing Management Reports	5	13	18	15	9	3.17	60

Not quite half the respondents who supplied syllabi and comprehensive assignment prompts required a report similar to a management report in their technical communication classes. Of the 17 sample syllabi and comprehensive assignment prompts, seven (41.2%) included some type of management report, including progress reports, recommendation reports, reports to decision makers, and usability reports.. The management reports were worth an average of 23.1% of the final course grade, with a range of 5% to 60%.

3.2.6 Manuals

Instructors of technical writing believe that engineers spend more time reading manuals than they do writing them. When asked how much time they believe engineers spend reading manuals, instructors gave a mean score of 3.64. No instructors indicated that they felt engineers Very Rarely read manuals, and only nine (14.8%) believe engineers Rarely read manuals. Instead, most (38 participants, 62.3%) believe that engineers Often (28 participants; 45.9%) or Very Often (10 participants; 16.4%) read manuals while in their professional careers. Fourteen instructors (23%) responded Neutral when asked how much time engineers spend reading manuals.

Overall, the instructors did not feel that engineers spend as much time writing manuals. Nineteen instructors (31.1%) responded that engineers Rarely (18 participants; 29.5%) or Very Rarely (1 participant; 1.6%) wrote manuals while at work, and thirty (49.2%) felt that engineers Often (20 participants; 32.8%) or Very Often (10 participants; 16.4%) spent time writing manuals. With 12 instructors (19.7%) responding Neutral, the mean score for time engineers spend reading manuals is 3.64.

Table 3.11 provides details on the instructors' responses when asked how much time they believe engineers spend reading and writing manuals in their professional jobs.

Table 3.11 How much time do engineers spend reading and writing manuals in their professional jobs?

Question	Very Rarely	Rarely	Neutral	Often	Very Often	Mean	Responses
Reading Manuals	0	9	14	28	10	3.64	61
Writing Manuals	1	18	12	20	10	3.33	61

While most instructors feel that engineers spend considerable time reading manuals, they don't weigh the activities as heavily as one may assume. The mean score for the emphasis that instructors put on reading manuals is 3.26, with not quite half (30 participants; 49.2%) weighing reading manuals Heavily (21 participants; 34.4%) or Very Heavily (9 participants; 14.8%). Five instructors (8.2%) weigh reading manuals Very Little in their classes, and 13 (21.3%) put Little weight on reading manuals. With 13 participants (21.3%) responding Neutral, the mean for emphasis put on reading manuals in technical communication classes is 3.73.

The instructors who responded to the survey weigh writing manuals more heavily than reading manuals in their classes. Of 62 instructors, 41 (66.1%) indicated that they weigh writing manuals Heavily (19 participants; 30.6%) or Very Heavily (22 participants; 35.5%). While only three (4.8%) weigh the writing of manuals Very Little in their classes, 12 instructors (19.4%) weigh writing manuals Little. Six respondents (9.7%) responded Neutral, bringing the mean for the question to 3.73, just under Heavily.

Refer to Table 3.12 for details of the responses instructors provided when asked how heavily reading and writing are weighed in their technical communication classes.

Table 3.12 How heavily are reading and writing manuals weighed in your technical communication classes?

Question	Very Little	Little	Neutral	Heavily	Very Heavily	Mean	Responses
Reading Manuals	5	13	13	21	9	3.26	61
Writing Manuals	3	12	6	19	22	3.73	62

Few instructors listed the word *manual* on their syllabi or comprehensive assignment prompts, but several required instructions, which were classified under manuals for the purpose of this study. Seven of the seventeen syllabi and comprehensive assignment prompts (41.2%) required an assignment that had components of a manual, including technical instructions and procedures. These manual assignments accounted for an average of 15.2% of the students' final grade, with a range of 5% to 30% of the final course average.

3.2.7 Additional Assignments

In addition to the assignments listed in my survey and Cunningham and Stewart's study, an analysis of the syllabi indicated that instructors also require other common assignments in their technical and professional communication classes. The most common assignment other than those already discussed was presentations. Of the seventeen syllabi and comprehensive assignment prompts provided, thirteen (76.5%) required some type of presentation. The presentation tied with proposals for the most common assignment in the technical communication classes. The presentations account for an average of 9% of the final grade, with the most common weight given being 10%. The highest weight for presentation grades was 15% and the lowest was 4%.

Definitions, case studies, and employment application materials were also common assignments in technical writing classes. Of those, the most common was employment materials, including application letters, resumes, interview sessions, and appreciation letters, which close to a third of instructors (5 instructors; 29.4%) required. The weight of those materials on the final course grade was moderately high; the overall average weight for employment materials on final course average was 16.8%. The highest weight of employment materials was 23.1%, and the lowest weight was still fairly high at 10%.

Three instructors of the seventeen who supplied syllabi or comprehensive assignment prompts (17.6%) required case studies, and the same number required definitions. The definitions were worth slightly more of the final course grade than the case studies. Definitions were worth an average of 8.28%, while the case studies were worth an average of 7.91%. The weight of the case studies, however, had a larger spread. Case studies accounted for 3.75% to 15% of the final course grade, while definitions were worth no more than 10% with the lowest weight for a definition the same as the lowest weight for a case study at 3.75%.

Interestingly, a third of the respondents who provided a syllabus or a comprehensive assignment prompt incorporated some type of multimodal assignment. Five of the seventeen syllabi (29.4%) have an assignment with a multimodal component, including assignments that required students to create wikis, incorporate visual rhetoric, design websites, and author blogs. While the multimodal assignments did not impact the final grade as much as the employment materials, they were worth more than the definitions and case studies. The average weight of the multimodal assignments on the final course grade was 14.98%, with a range of 7.69 to 22.2%.

Another common theme in the syllabi and comprehensive assignment prompts provided for this study was the requirement for students to do some type of collaborative work. Over three-quarters of the syllabi and comprehensive assignment prompts required some type of collaborative work. Of the seventeen respondents, thirteen (76.5%) included group work as part of the course requirements. The group work was usually combined with other assignments, such as requiring students to work together and create a proposal, so most of the assignments that were classified as collaborative were also categorized as another type of assignment. The collaborative work was worth an average of 30.32% of the final course grade, with a range of 5% to 55%.

3.3 Evaluating Work in Engineering

In addition to working to determine instructors' perceptions of the reading and writing engineers do in their professional careers, my research project also considered how much time the instructors feel engineers spend evaluating and editing the work of other engineers as well as how the instructors evaluate written work. The first step was to determine if instructors have an accurate view of how much time engineers spend evaluating and editing written work in their professional careers. To work towards an answer, I included different survey questions regarding the role of evaluating work in engineering careers and in technical communication classes and the criteria used by both groups when evaluating writing.

The first set of questions asked instructors how much time they believe engineers spend evaluating documents and editing other people's writing, with options from Very Rarely to Very Often (Very Rarely scoring a one and Very Often scoring a five). When asked how much time engineers spend evaluating documents, 61 instructors responded with a mean score of 3.77. Forty-four (72.1%) of the responders indicated that they believe that engineers evaluate documents Often (28 participants; 45.9%) or Very Often (16 participants; 26.2%), and only one instructor (1.6%) indicated that they feel engineers Very Rarely evaluate documents. Eleven respondents (18%) indicated that engineers Rarely evaluate documents, and five (8.2%) selected Neutral.

On the contrary, instructors don't believe the engineers spend as much time editing other people's work as evaluating documents. Almost a third of the participants (20 respondents, 32.8%) indicated that they feel the engineers Very Rarely (7 participants; 11.5%) or Rarely (13 participants; 21.3%) edit other people's work. A total of 25 instructors (41%) believe that engineers edit people's writing Often (21 participants; 34.4%) or Very Often (4 participants; 6.6%). Sixteen participants (26.2%) responded Neutral, which is where the mean score for how often engineers edit other people's work fell at 3.03.

Table 3.13 outlines the instructors' views of how much time engineers spend evaluating and editing in their professional jobs.

Table 3.13 How much time do engineers spend evaluating and editing in their professional jobs?

Question	Very Rarely	Rarely	Neutral	Often	Very Often	Mean	Responses
Evaluating Documents	1	11	5	28	16	3.77	61
Editing Other People's Work	7	13	16	21	4	3.03	61

Although many of the instructors surveyed do not agree that engineers spend considerable time evaluating documents or editing other people's work, they still weigh the processes fairly heavily in their classes. None of the instructors reported that they give Very Little weight to evaluating documents in their technical communication classes, and only one (1.6%) indicated that evaluating documents held Little weight. The vast majority weighed evaluating documents at least Heavily in their classes, with 22 instructors (35.5%) responding

Heavily and 33 (53.2%) indicating Very Heavily. Only six instructors (9.7%) selected Neutral, leaving the mean for how much evaluating document is weighed in technical communication classes fairly high at 4.40.

Instructors highlight editing other people's work less than they do evaluating documents, but they still put Heavy emphasis on editing the work of other people in their classes. Forty-seven respondents (75.8%) indicated they put Heavy (23 participants; 37.1%) or Very Heavy (24 participants; 38.7%) emphasis on editing other people's work. Five instructors (8%) reported that they weigh editing other people's work Little (4 participants; 6.5%) or Very Little (1 participant; 1.6%). Ten participants (16.1%) selected Neutral, resulting in a mean score of 4.05.

Table 3.14 shows how much instructors weigh evaluating and editing documents in their technical communication classes.

Table 3.14 How heavily are evaluating and editing weighed in your technical communication classes?

Question	Very Little	Little	Neutral	Heavily	Very Heavily	Mean	Responses
Evaluating Documents	0	1	6	22	33	4.40	62
Editing Other People's Work	1	4	10	23	24	4.05	62

While instructors reported that they believe engineers spend time evaluating work, less than half supplied syllabi and/or assignment prompts that had evaluation as part of assignment requirements. Of seventeen syllabi and comprehensive assignment prompts supplied, eight (47.1%) incorporated evaluation assignments. Those assignments included analyzing technical descriptions and genres, completing peer reviews, offering critiques, and reflecting on personal work. For those who required a formal evaluation assignment, the average weight for the assignment was 9.58% of the final course grade. The lowest weight given to evaluation assignments was 3.75% and the highest was 20%.

3.3.1 Evaluating Work of Engineering Students

Instructors were also asked how they evaluate work in their technical communication, technical writing, and/or professional writing classes. Sixty instructors responded to the series of questions regarding evaluation of student work. For each statement, instructors were asked if they considered it Very Trivial, Trivial, Neutral, Crucial, Very Crucial, or N/A. No instructors answered N/A for the questions related to evaluating student work.

The first statement asked for participants to indicate their attitudes towards the following statement: “Technical documents should cover topic with appropriate and proper detail.” Of the 60 respondents, none considered the statement either Trivial or Very Trivial, and only two (3.3%) selected Neutral. Two-thirds (40 instructors; 66.7%) indicated that it was very crucial and 18 (30%) considered it crucial, creating a mean score of 4.63.

The instructors found the statement “Technical documents should describe information’s importance and implications” almost as crucial, with the statement’s mean value of 4.60 making it the second most crucial element of those listed for evaluating technical documents. Again, no one considered it Very Trivial, but unlike the statement regarding proper detail, one person (1.7%) did indicate that describing information’s importance and implications was Trivial; one instructor (1.7%) also gave a score of Neutral. Instead, the statement was seen as important when evaluating work. Nineteen instructors (31.7%) indicated that it was Crucial, and 39 (65%) felt that describing information’s importance and implications is Very Crucial.

Instructors also felt it was important for “technical documents to use precise language to express meaning,” with the statement earning a mean score of 4.47. Only one instructor (1.7%) found precise language to be very Very Trivial, and two (3.3%) found it to be Trivial; in addition, two (3.3%) selected Neutral when asked about precise language. The vast majority, 55 instructors (91.7%) indicated that precise language was either Crucial (18 participants; 30%) or Very Crucial (37 participants (61.7%), with Very Crucial gaining the most responses.

The survey participants did not feel as strongly that "technical documents should provide a true understanding and representation of the subject." While only three instructors (5%) found the statement to be either Trivial (2 participants; 3.3%) or Very Trivial (1 participant; 1.7%) – the same number who found precise language Trivial or Very Trivial – the number who consider a true understanding and representation of the subject Very Crucial dropped to 34 participants (56.7%). Nineteen respondents (31.7%) found the criterion Crucial. Four participants (6.7%) selected Neutral, resulting in a mean score of 4.38.

Of the instructors who responded to the evaluation questions, three considered (5%) the criterion "technical documents should use simple, direct language" Trivial (2 participants; 3.3%) or Very Trivial (1 participant; 1.7%). Simple, direct language was considered Very Critical by just over half of the instructors (31 participants; 51.7%), and 16 (26.7%) rated it Critical. Interestingly, the statement was rated as Neutral by 10 participants (16.7%), giving it a mean score of 4.23.

The statement respondents agreed with the least was "technical documents should be grammatically correct." While no instructors reported that grammar is Very Trivial in their grading of technical documents, three (5%) report that grammar is a Trivial consideration when evaluating student work. Eighteen instructors (30%) consider it Very Crucial, and 26 (43.3%) consider it Crucial. Thirteen selected Neutral when asked about the importance of grammar in the evaluation of assignments. As a result, the importance of grammar had a mean score of 3.98, the lowest mean score of all evaluation criteria.

Table 3.15 provides an overview of how the instructors rated the evaluation statements based on how they grade work in their technical communication, technical writing, or professional writing classes.

Table 3.15 Rate the following statements based on how you grade work in your technical communication, technical writing, or professional writing classes.

Statement	Very Trivial	Trivial	Neutral	Crucial	Very Crucial	Mean	Responses
Technical documents should cover topic with appropriate and proper detail	0	0	2	18	40	4.63	60
Technical documents should use precise language to express meaning	1	2	2	18	37	4.47	60
Technical documents should provide a true understanding and representation of the subject	1	2	4	19	34	4.38	60
Technical documents should use simple, direct language	1	2	10	16	31	4.23	60
Technical documents should be grammatically correct	0	3	13	26	18	3.98	60
Technical documents should describe information’s importance and implications	0	1	1	19	39	4.60	60

3.3.2 Rubric Results

In addition to the quantitative responses from survey participants regarding evaluation of student work, I also asked participants to submit rubrics so I could analyze how instructors assess quality writing. The criterion from each rubric were grouped according to the standards set by the Analytic Writing Continuum: Content, Structure, Stance, Sentence Fluency, Diction, and Conventions (Swain and LeMauieu). Criterion that did not fall into one of the six Analytic Writing Continuum's writing traits were classified as Other and fell into one of three categories: Assignment Requirements, Formatting, or Visuals.

The first Analytic Writing Continuum trait is Content, which includes "quality and clarity of ideas and meaning" (Swain and LeMahieu 49) and a "central theme or topic, quality and clarity of ideas and meaning" (Bang 13). Of the ten rubrics used for analysis, all but one (90%) included some type of criterion for content, and most of those nine rubrics included more than one statement assessing content. Seven of the nine (77.8%) rubrics that had Content criteria incorporated multiple evaluation statements regarding content, indicating that instructors consider Content an important criterion for writing. In total, there were 25 content-related evaluation criteria in the nine syllabi that contained Content statements. The average syllabus had 2.8 Content statements with each sample rubric including between one and five. The most common number of content statements on a syllabus was 2; three of the syllabi (33.3%) had two content statements. Interestingly, the second most common number of content statements was neither one nor three, as one may expected. Instead it was five. Of the nine syllabi with content statements, two had five individual content statements (22.2%).

Figure 3.4 shows a breakdown of the number of Content statements per rubric.

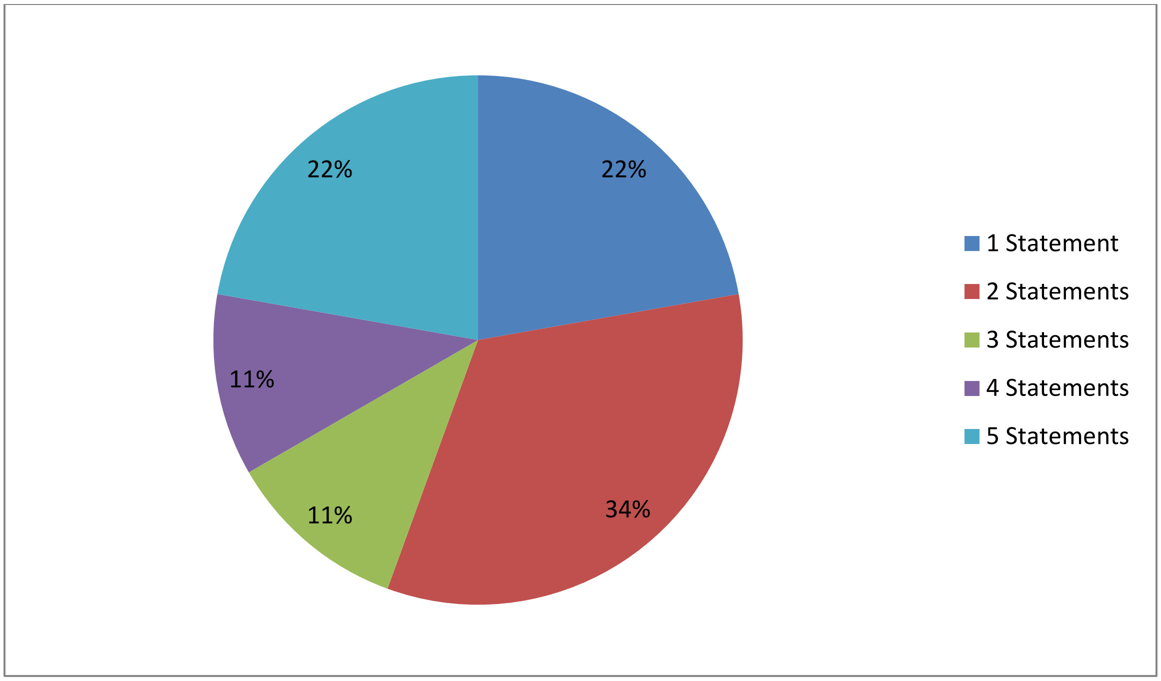

Figure 3.4 Number of Content Statements per Rubric

The second criterion on Analytic Writing Continuum's writing criteria, Structure, includes "logical arrangement, coherence, and unity" (Bang). In total, there were fifteen statements related to structure on the rubrics submitted, and those fifteen statements appeared on eight of the ten rubrics (80%) submitted for the study.

Of the rubrics that had structure statements, six had multiple structure statements with the average number of structure statements per rubrics falling just under 2, at 1.9. The eight rubrics had a range of one to three of structure statements per syllabus, with five rubrics including two structure statements, the most common number of structure statements per rubric. Only one rubric included three Structure statements, while two had only one criterion related to structure on the rubric. Refer to Figure 3.5 for a breakdown of the appearance of Structure statements on sample rubrics.

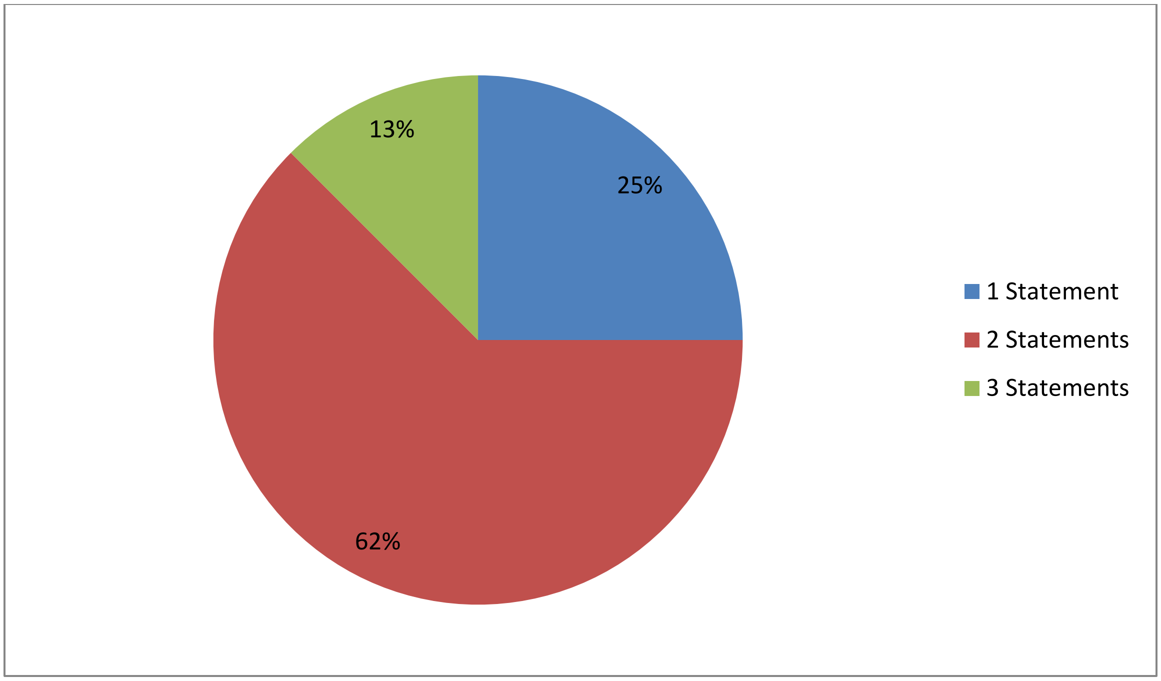

Figure 3.5 Number of Structure Statements per Rubric

The next criteria on Analytic Writing Continuum's writing criteria is Stance, which according to Bang includes "perspective communicated through level of formality, style, and tone appropriate for the audience and purpose." Seven rubrics included a total of 23 stance statements; three of the ten rubrics submitted did not include statements that would be classified as Stance statements. Of the seven rubrics that included Stance statements, the vast majority included more than one Stance statements; five (71.4%) included more than one stance statement. The rubrics with multiple Stance statements had between two and seven criteria that was identified as Stance statements. Although there was a higher concentration of stance statements than any other statement type on a single rubric, the average number of stance statements per syllabus was fairly low at 2.14.

Figure 3.6 shows the distribution of Stance statements on sample rubrics from this study.

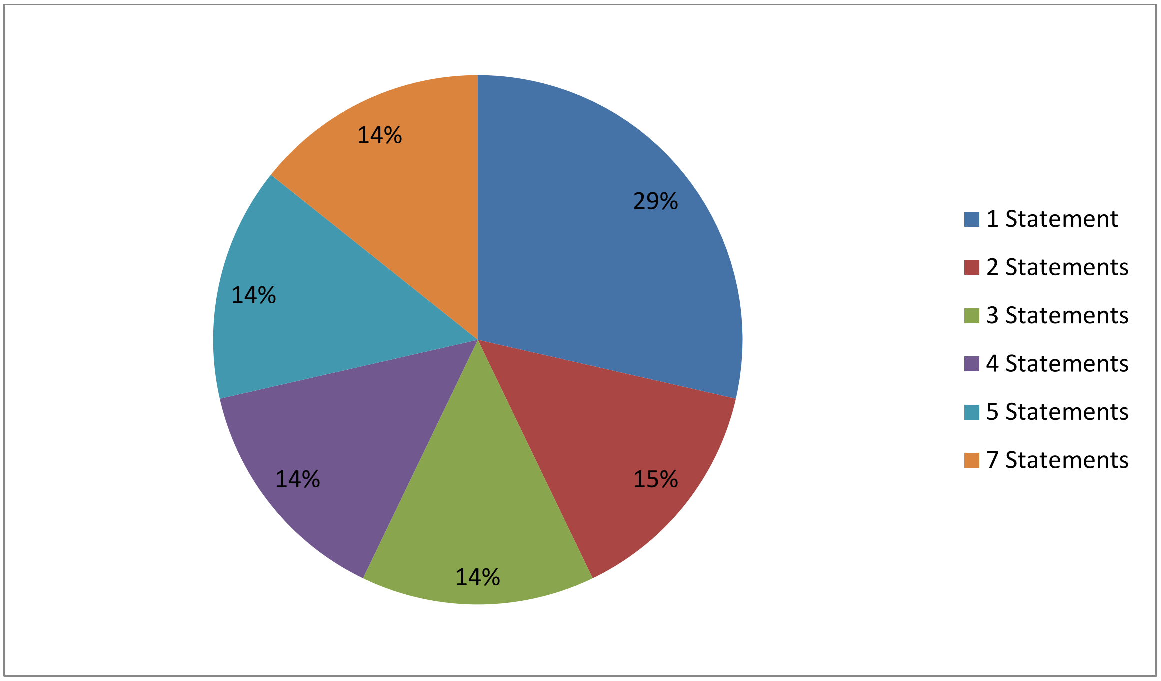

Figure 3.6 Number of Stance Statements per Rubric

The Analytic Writing Continuum also considers sentence fluency, which is defined as "rhetorical features, rhythm, and flow crafted to serve the purpose of writing" (Bang). In total, there were eight statements that were classified as Sentence Fluency statements. Those statements appeared on a total of 5 rubrics, or 50% of the total rubrics submitted. Of the five rubrics that included sentence fluency statements, four (80%) included only one statement related to sentence fluency. The remaining rubric included four statements that were classified as sentence fluency statements. While it was by far most common to have one Sentence Fluency statement per syllabus, the average was actually 1.6 because of the outlier that incorporated four sentence fluency statements on a single rubric.

The Analytic Writing Continuum also suggests diction as a criterion when evaluating writing. Diction statements include evaluation of words, looking specifically for language that offers "Precision and appropriateness of the words and expressions for the writing task" (Bang).

Diction statements had a similar presence as sentence fluency statement on the rubrics that were provided for the study. While diction statements appeared on five of the sample rubrics (50%), the same as sentence fluency statements, the diction statements had a wider spread. Diction statements occurred an average of 1.6 times, the same as the sentence fluency statements, but the diction statements ranged from one to three statements per rubric. Three of the rubrics had only one Diction statement, while only one rubric had two Diction statements and one had three statements related to diction.

Figure 3.7 illustrates the distribution of Diction statements on sample rubrics from this study.

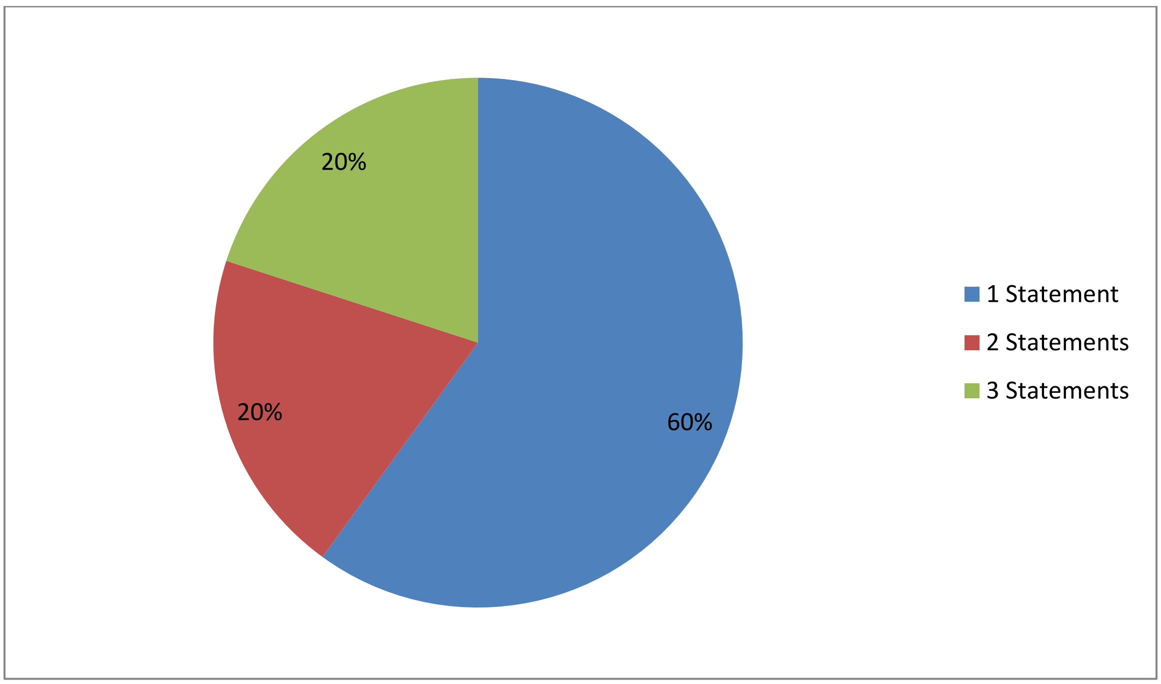

Figure 3.7 Number of Diction Statements per Rubric

The last of Analytic Writing Continuum's criteria is Convention, which includes "usage, punctuation, spelling, paragraphing" (Bang), what many composition instructors refer to as grammar. Nine of the ten (90%) rubrics that were submitted include statements related to grammar. The vast majority, 8 of 9 (88.9%) of the rubrics contained only one Convention statement, but one of the nine (1.1%) include two Convention statements, resulting in an average of 1.1 Convention statement per syllabus.

In addition to the rubric statements the fit criteria outlined by the Analytic Writing Continuum, the rubrics provided for the study also included statements that couldn't be classified as Content, Structure, Stance, Sentence Fluency, Diction, or Conventions. Those statements were classified as *Other*, and were sub-categorized by their function. There were three categories of Other statements: Other-Assignment Requirements, Other-Formatting, and Other-Visuals. All were listed with the prefix *Other* to indicate that the associated criterion is not part of the Analytic Writing Continuum.

The first category that was not associated with the Analytic Writing Continuum statements was Other-Assignment Requirements statements. Five of the ten (50%) sample rubrics included evaluation criteria related to the assignment requirements. These statements indicate that the student would lose points for work that did not meet all elements of the assignment, such as length, citation styles, and due date. Of the submitted rubrics that included Assignment Requirements statements, all but one (80%) had two statements related to assignment requirements. No syllabus had more than two Assignment Requirement statements, resulting in an average of 1.8 assignment requirement statements per syllabus.

In addition to the Assignment Requirement statements, several rubrics contained criteria based on document design. Of the ten rubrics evaluated in this study, seven (70%) included statements related to document design. Two of the seven (28.5%) included two statements, and the remaining five (71.4%) had only one statement related to document design. No rubric included more than two document design statements.

The last category of rubric evaluation statements is Other-Visuals Statements, which appeared on four of the ten rubrics (40%). None of the four rubrics had more than one Other-Visual Statement; they all contained only one. All of the Other-Visual statement specifically related to graphics in the document, including but not limited to tables, charts, graphs, and pictures.

4 ANALYSIS AND RECOMMENDATIONS

Once the data was collected, I took several steps to analyze the data and determine the implications of the information collected. The first step was to examine the research from the instructors to identify the way they view the reading and writing requirements of professional engineers. I then compared the instructors' views to the reports of professional engineers from Cunningham and Stewart's study to provide a foundation for evaluation of how well technical writing, technical communication, and professional communication prepare students for the reading and writing requirements of professional engineering jobs. I then considered the assignments given in technical writing classes and compared that information to the reading and writing requirements of professional engineers to identify both parallels and gaps. Finally, I reviewed the evaluation methods used by instructors and considered how well the instructors' views of effective writing match what criteria the engineers deem necessary for quality writing. The comparison of the instructors' views and the engineers' provides an overview of how well the classroom assignments meet the communication needs of future engineers and give a foundation to make recommendations for changes in the technical writing classroom to help better meet the reading and writing demands of future professional engineers.

4.1 Analysis of Reading

While the focus of technical writing, technical communication, and professional writing classes is naturally on writing, I started my study by considering the reading that engineers do and the requirements of reading in technical writing classes. As Cunningham and Stewart found, engineers spend considerable time during their professional day reading different documents, especially correspondence and technical reports. Fortunately, the results of the study clearly indicate that instructors have a good idea of how much time professional engineers spend reading and what types of documents engineers read. Of the six types of communication (correspondence, meeting minutes, technical reports, management reports, proposals, and manuals), three types (50%) resulted in less than a quarter-point difference between the instructors' responses and the engineers': correspondence, technical reports, and proposals. Of the three, engineers and instructors agreed most closely on the time engineers spend reading correspondence. Engineers responded with an average score of 4.86 (Cunningham and Stewart) while the instructors had an average score of 4.7, resulting in only a .16 point difference. With a difference of .17 point, technical reports were almost just as close, although the engineers indicated that they spend a little less time reading technical reports than the instructors anticipated. The difference between how much time instructors and engineers say professional engineers spend reading proposals on the job was a little higher but still relatively close at .24 points. Like the results for reading correspondence, the instructors' responses indicated that they feel that engineers spend less time reading proposals than professional engineers report they actually do.

The instructors also scored relatively close to the engineers from Cunningham and Stewart's study in two other areas of reading: manuals and management reports. The instructors returned an average score of 3.46, halfway between Neutral and Often, when asked how much time they believe engineers spend reading manuals; the engineers' average response was just above Often at 4.06 (Cunningham and Stewart). The difference of .42 is higher than the differences for correspondence, technical reports, and proposals, but it is still shows that instructors have a fairly clear understanding of the correspondence reading requirements of professional engineers. The difference in responses for time spent reading management reports was a little higher at .56, with instructors responding that they believe that engineers spend more time reading management reports than engineers indicate they do.

The biggest discrepancy was in the time that instructors believe engineers spend reading meeting minutes; instructors ranked the reading of meeting minutes at an average of 2.74, between Rarely and Neutral but closer to Neutral, and the engineers reported that they read meeting minutes almost a full point higher, with an average of 3.68, closer to Often. This discrepancy is interesting because meeting minutes are the only type of assignment that did not appear on any of the syllabi provided for the study.

Figure 4.1 shows a comparison between the instructors' responses and the engineers' responses when asked how much time engineers spend reading specific documents during the professional day.

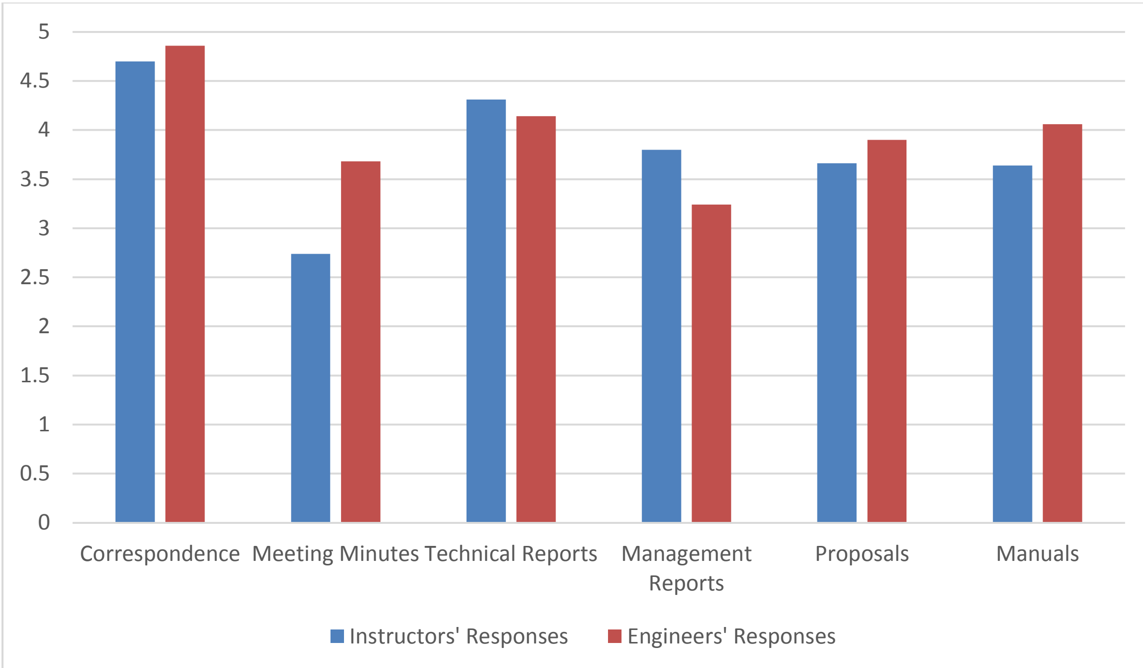

Figure 4.1 Time Engineers Spend Reading Documents

While instructors have a good understanding of the reading requirements in professional engineering, they don't apply that information to their course design. By their own admission, instructors note that they do not emphasize reading assignments as heavily as other course requirements, such as writing the documents. With the exception of time spent reading proposals, the instructors consistently report that the time they feel engineers spend reading documentation is higher than the emphasis the same instructors put on reading the same documents in their classes. Excluding proposals (which had only a .05 point different between how much time instructors believe engineers spend reading the documents and how much emphasis they put on reading proposals in their classes), the other five types of documentation had almost a full point average (.97) difference between what the instructors believe engineers do on the job and how much time they emphasize those skills in their classes. The largest difference was in the time spent reading correspondence. Instructors believe that engineers spend considerable time reading correspondence, returning an average close to Very Often at 4.7, but they emphasize it almost a full point and half lower at 3.27 when they teach their classes. Both management reports and meeting minutes also had more than a full point difference in instructors' perceptions and emphasis in technical writing classes. Management reports had a 1.16 difference with instructors believing engineers spend an average of 3.8 points but emphasizing reading the document in their classes only 2.64 points on a five-point scale, a difference of 1.16. Meeting minutes had a difference that was closer to one point, but still fairly high. The difference for the meeting minutes was 1.07, with instructors' perceptions being 2.74 and their emphasis in class being 1.67.

Time spent reading both technical reports and manuals came back with a smaller difference. Technical reports were under one point difference, at .83, with instructors believing engineers read technical reports more than Often at 4.31 emphasizing the reading of the same documents in their classes less frequently at 3.48. Manuals had the smallest discrepancy at .38 (excluding proposals, which was essentially even). Instructors gave an average score 3.64 and they emphasize it 3.26 in their classes.

Refer to Figure 4.2 for a comparison of the instructors' perceptions of the time engineers spend reading specific types of documents and the emphasis instructors put on reading the same documents in their courses.

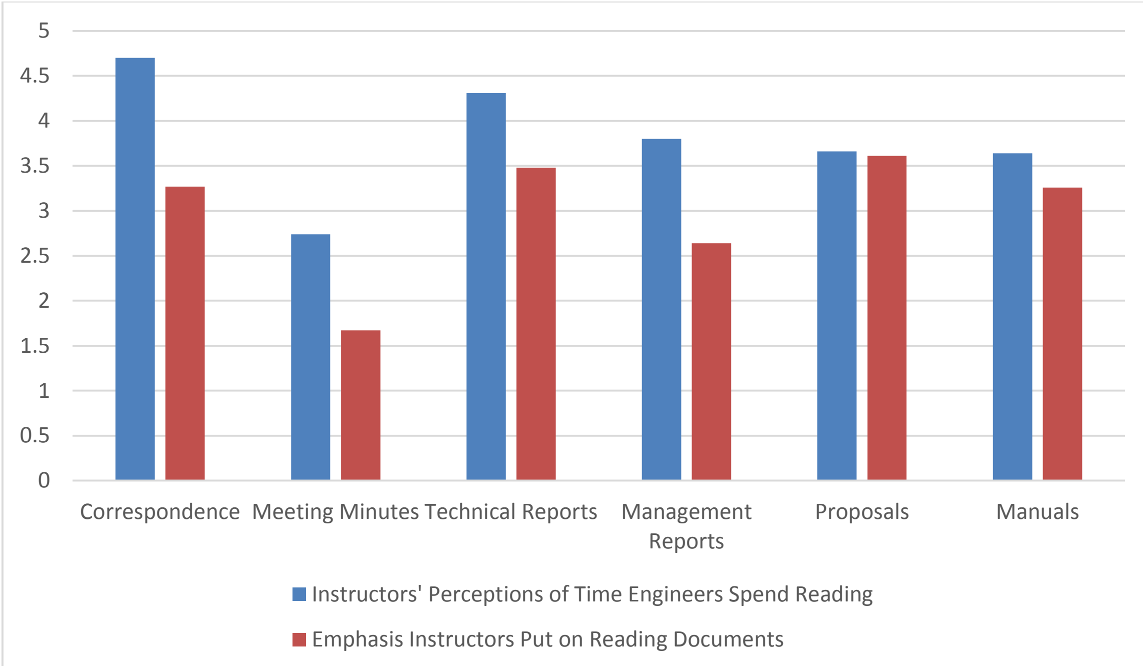

Figure 4.2 Instructors' Perceptions vs. Classroom Emphasis Reading Documents

The gap in reading of correspondence is concerning, especially considering the time engineers spend reading and writing correspondence. Of course, the lack of emphasis on reading correspondence in technical writing classes makes sense considering that correspondence is not limited to the field of engineering or technical writing. Correspondence, especially in the form of emails, is prevalent in all areas today, not just professional settings. Since it is so common, instructors often believe that students know how to read correspondence, and they may be right. Students are force to use email to communicate with their instructors throughout their college career. But it is also common to hear instructors complain about students not reading emails, which suggests that it might benefit students to learn about reading correspondence in their college classes.

Correspondence is not the only type of document that instructors do not spend time reading in their technical writing classes. Meeting minutes are obviously not emphasized in the classes, as indicated by the lack of meeting minutes on any of the syllabi that were submitted for this study. The omission of meeting minutes on any of the syllabi can indicate a variety of things. At first, it might suggest that instructors do not have a clear understanding of the role the meeting minutes play in professional engineering careers. And while that might be possible, after all most of the instructors of technical writing, technical communication, or professional writing are not professional engineers, there are other possible causes for the lack of meeting minutes in technical writing classes. From the study it is evident that the instructors are aware engineers read minute minutes, even if they believe engineers don't read meeting minutes as often as they report to, but the instructors may not feel that it would benefit students to read meeting minutes as part of the class assignment because they see meeting minutes as documents that have characteristics not specific to technical writing or engineering. In addition, they may assume that the skills to understand meeting minutes are transferrable and can be picked up from reading other documents. The question of transferability is one that must be explored before we can conclude that excluding the reading of meeting minutes in technical writing classes is not detrimental to the students' future professional careers.

4.2 Analysis of Writing

While reading is essential to written communication skills, the course objectives for most technical writing, technical communication, and professional writing revolve around writing, so the next stage of my research project was to determine how well the instructors understand the writing demands of professional engineers. Both the engineers from Cunningham and Stewart's study and the instructors who completed this survey agree that the three types of documents engineers write most frequently include Correspondence (letters, emails, memos, faxes), Technical Reports, and Proposals. The two groups also agreed on the order of importance of the three types of documents; both groups indicated they perceive that engineers spend the most time writing Correspondence, followed by technical reports, and then proposals. However, when ranking the less most common types of documents engineers write, the instructors and engineers do not agree. Engineers report that they spend the least amount of time writing Manuals (Cunningham and Stewart), while instructors believe that engineers write Meeting Minutes less frequently than the other types of documents in the survey.

The instructors' perceptions regarding how much time engineers spend writing correspondence are in line with how the engineers claim they spend their time. The difference between the instructors' responses and the engineers' was only .13 on a five-point scale; engineers rated the time writing correspondence close to Very Often, with an average of 4.83 points (Cunningham and Stewart), and the instructors perceive that engineers spend just a little less time writing correspondence and gave it an average score of 4.7. The difference of only .13 is minimal and shows that instructors have a fair clear understanding of how much time engineers spend writing correspondence.

Similarly, the responses for the time engineers spend writing proposals were fairly consistent between the instructors in this research project and the engineers from Cunningham and Stewart's study. The instructors believe that engineers spend a decent amount of time writing proposals, returning an average score of 3.87, which is just .13 points shy of Often; the engineers' average response was just a little closer to Neutral at 3.49 (Cunningham and Stewart). While the difference between the engineers and instructors is notably higher for writing proposals than for writing correspondence, at .38 points, it is still fairly small and indicates that instructors have a good, basic understanding of how much time engineers spend writing proposals.

The instructors' perceptions of the time engineers spend writing the other types of documents did not align as well with how engineers report they spend their time. The largest discrepancy was related to management reports, with engineers reporting that they spend less time writing management reports than instructors believe they do. On the five-point scale, instructors rate the frequency that engineers write management reports almost a full point higher than the engineers reported. The instructors gave time engineers spend writing management reports an average of 3.69, while the engineers responded with an average of 2.74 (Cunningham and Stewart).

Instructors also overestimated how much time engineers spend writing manuals and technical reports, although the instructors' estimate of time spent writing technical reports was closer to the engineers' responses than estimates of manual writing. Engineers and instructors had just under a half-point difference (.48) when asked how much time they believe engineers spend writing technical reports. Engineers reported that they write technical reports between Often and Very Often with a score of 4.21 (Cunningham and Stewart). Instructors do not believe that engineers spend quite as much time writing technical reports, returning a score of 3.73. The difference between the engineers and instructors was almost double (.85 point) when asked about time spent writing manuals. Again, instructors over estimate how much time engineers spend writing manuals giving the time spent writing manuals an average score of 3.33, while the engineers give it a much lower 2.48 (Cunningham and Stewart).

The last type of documentation, meeting minutes, had a fairly large difference between instructors and engineers, but the biggest difference is that the instructors underestimated how much time engineers spend writing meeting minutes, which parallels how the instructors underestimated the time engineers spend reading minutes. While engineers give time spent writing meeting minutes a score of 2.57 (Cunningham and Stewart), instructors believe engineers write meeting minute much more often, giving it an average score of 3.29. While this discrepancy is important because it is fairly large at .72, it is also important because it is only one of two types of documents that instructors overestimated. The other was correspondence, which had a very small difference of only .13.

The question then becomes why instructors underestimate the time engineers spend writing meeting minutes. There are a few considerations that should be contemplated when pondering this question. The primary factor is that many instructors have limited experience in corporate settings, and as a result, may not understand the policies and procedures in professional engineering settings. Even if they understand what engineers do, a difficult concept considering the variety of engineering positions and expectations, the processes used by engineers to document meetings and record shared information may not be clear to instructors of technical writing. In addition to a limited understanding of business protocol, instructors may not view meeting minutes as an assignment that is applicable to the goals and objectives of technical writing classes. Meeting minutes are often seen as business communication that lacks the same elements of technical communication, which can explain why instructors don’t emphasize writing meeting minutes in technical writing classes.

Refer to Figure 4.3 for a comparison of the instructors’ perceptions of the time engineers spend writing specific types of documents and the time engineers say they spend writing the same document types in their professional careers.

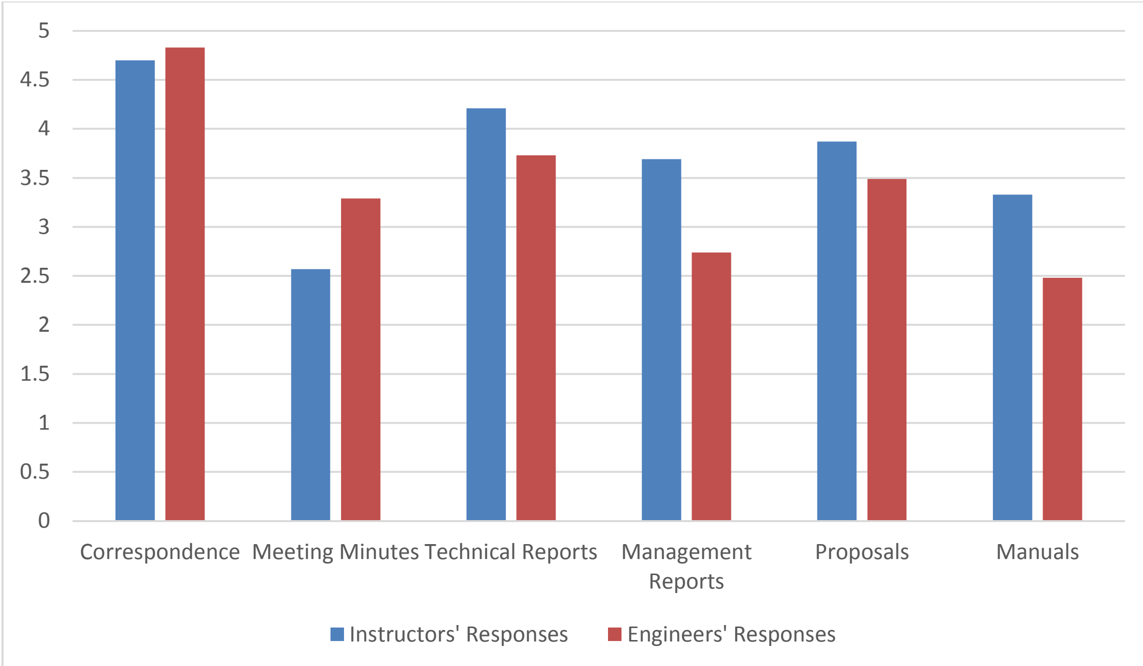

Figure 4.3 Time Engineers Spend Writing Documents

The real discrepancy comes in when we look at the assignments that technical writing instructors require in their courses. Although the survey responses indicated that instructors feel engineers spend considerable time writing correspondence (it ranked highest of the six types of writing), it was emphasized less than technical reports and proposals. The proposals, which instructors perceive engineers write less than two other types of documents (correspondence and technical reports), were emphasized the most in their technical communication classes. As with reading correspondence and reading and writing meeting minutes, the problem may be that instructors do not view correspondence as technical documents to be taught in a technical writing, technical communication, or professional writing course. And since correspondence can be taught in other composition classes, it is reasonable that technical writing instructors decide to focus their course on other documents that are not likely to be highlighted in traditional composition classes.

The interesting part about this information is that the instructors do not place emphasis on what they feel the engineers do during the day. Instructors clearly feel engineers spend considerable time writing correspondence in their profession, ranking it highest of the six types of writing, at 4.7 on a five-point scale. Yet, the same instructors emphasized it less heavily than two of the other types of writing. The instructors said they weigh writing correspondence an average of 4.02 on a five-point scale. The discrepancies did not stop there, though. While the instructors agreed that writing correspondence was important to engineers, with only two (3.2%) responding Neutral when asked how much time do they believe engineers spend writing correspondence in their professional jobs, and 45 (73.8%) responding Very Often to the same question, only 64.7% actually incorporated some type of correspondence in their course requirements.

While instructors do not emphasize writing correspondence, they do emphasize writing proposals in their classes. The instructors reported believing that engineers spend more time writing proposals than they actually do (instructors rank proposal writing as 3.87 and engineers ranked it at 3.49); yet, instructors emphasize proposal writing more than any other type of writing in their classes, ranking it 4.29.

The largest gap between the perceptions that instructors have on how much time engineers spend writing and the weight of assignments in their classes is meeting notes. The instructors ranked meeting notes between rarely and neutral, at 2.57 (neutral is 3.0), so it makes sense that they would not emphasize writing meeting notes in their classes. And, they do not. The instructors reported that on a scale of one to five, with one being very little, they put an emphasis of 1.87 on writing meeting notes. The problem is that the engineers indicate they spend more time writing meeting notes than then instructors perceive. Engineers’ responses indicate an average of 3.29 for writing meeting notes, indicating that the time spent in the technical writing classroom learning how to write meeting notes and the job requirements for writing meeting notes do not match.

Refer to Figure 4.4 for a comparison of the instructors' perceptions of the time engineers spend writing specific types of documents and the emphasis instructors put on writing the same documents in their courses.

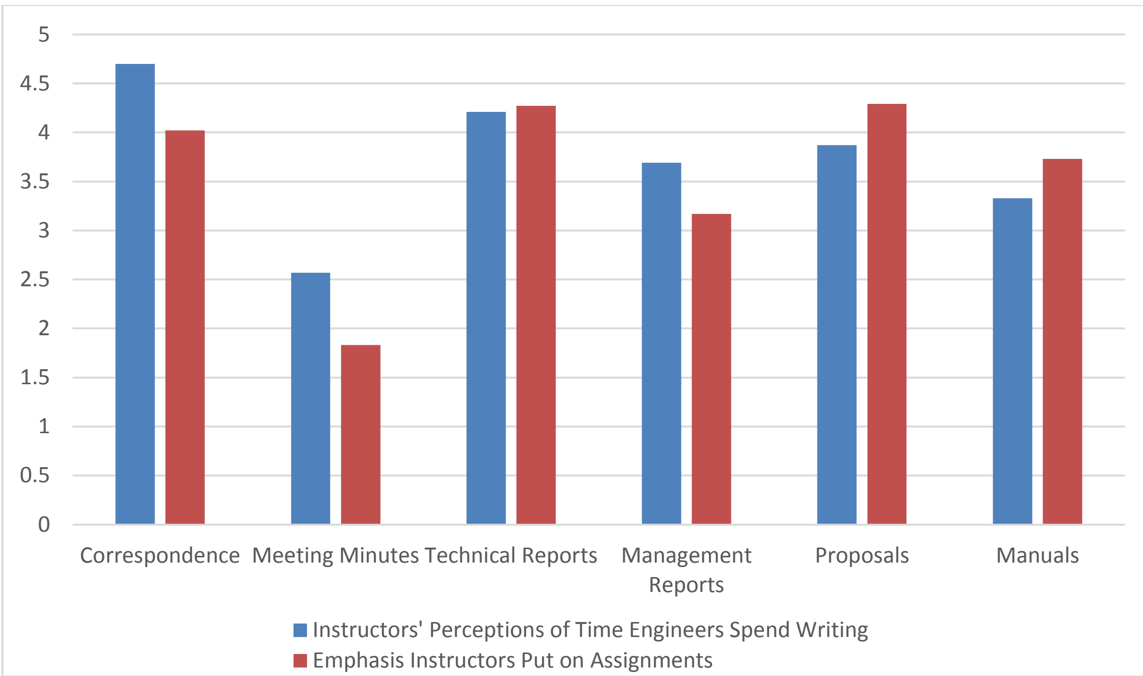

Figure 4.4 Instructors' Perceptions vs. Classroom Emphasis Writing Documents

4.3 Analysis of Evaluating Work

Overall, instructors and engineers agree on the characteristics of effective technical writing. When given six characteristics of writing, the engineers' and instructors' responses were very close to each other. Both groups rated the statement "Technical documents should be grammatically correct" as the least important characteristic of effective writing. On a five-point scale with 5 being Very Crucial and 1 being Very Trivial, engineers rated being grammatically correct at 4.13 (Cunningham and Stewart) and instructors rated it 0.15 points lower at 3.98. The rubrics show a different attitude towards grammar, though. Almost all of the rubrics submitted (90%) included statements about grammar, making Grammar tied with Content for the criterion that appeared more frequently on the rubrics submitted for the survey.

Instructors and engineers also agreed on the importance of proper diction, although they had some difference in the use of precise language. The survey included two statements that related to diction ("Technical documents should use precise language to express meaning" and "Technical documents use simple, direct language"), two statements that seem close enough that they would produce similar results. There was negligible difference (.02 point) between how the instructors and the engineers rank the use of simple, direct language, but there was a .20-point difference between how they rank precise language, which is still close but significantly higher than the difference for the use of simple, direct language. What is interesting, though, is that only half of the rubrics submitted include statements that would fall within this classification. Although the instructors ranked both characteristics higher than Crucial for effective writing (with a mean score of 4.47 and 4.32 on a five-point scale), only half provided syllabi that had evaluation criteria representing the Diction statements.

Instructors from my survey and engineers from Cunningham and Stewarts' survey had the biggest difference in how they rate the importance of content criteria. With a .38 point difference in the responses for "Technical documents should cover the topic with appropriate detail," the Content classification proved to show that engineers and instructors are not always on the same page when it comes to evaluating written work. Instructors ranked the criterion more important than engineers did, giving it a score of 4.63 while engineers gave it a score of 4.25 (Cunningham and Stewart). The other criterion that would be classified as Content did not have as big of a difference between the engineers' responses and the instructors'. The engineers gave the criterion "Technical document should provide true understanding and representation of the subject" a score of 4.52 (Cunningham and Stewart) and the instructors gave it a score of 4.38. All but one of the rubrics submitted (90%) included at least one criterion related to Content on their syllabi, so it is apparent that instructors not only say that content is important, but they emphasize it in their classes and grading as well. The instructors ranked the evaluation criterion "Technical documents should cover topic with appropriate and proper detail" as the most important criterion in judging the effectiveness of documents, and engineers ranked provide true understanding as most important. So they both think that content is extremely important for a document to be effectively written. This finding parallels the findings from the rubrics; all but one of the rubrics included information on Content.

The last criterion, "Technical documents should describe information's importance and implications" saw a fairly large gap between the instructors' ranking and the engineers'. The instructors ranked the criterion .37 points higher than the Cunningham and Stewart's engineers did, with the instructors returning an average of 4.6 and the engineers returning an average of 4.23. Seventy percent of the rubrics included statements regarding Stance.

Figure 4.5 outlines the characteristics of effective writing as identified by instructors of technical writing and by professional engineers.

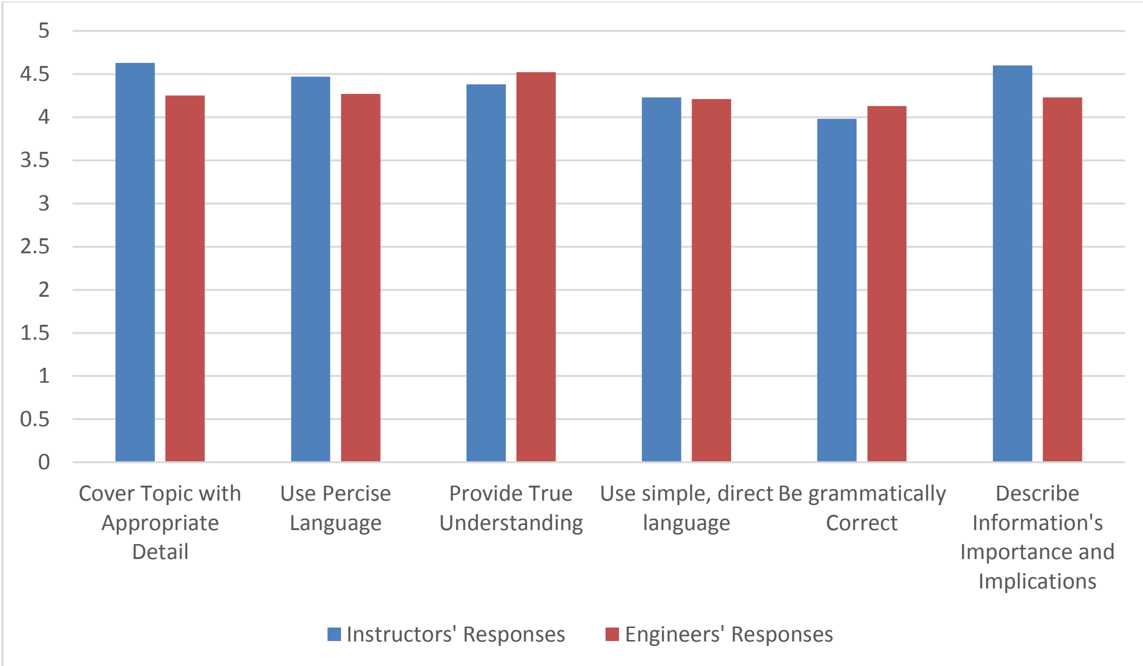

Figure 4.5 Quality Characteristics of Effective Technical Writing

4.4 Explanations for Discrepancies

As noted, there are discrepancies between what instructors believe engineers read and write on in their careers and the assignments given in their technical writing, technical communication, and professional writing classes. Instructors note that engineers spend considerable time of their day reading documents, yet they seldom assign reading technical documents as part of the course requirements. In addition, they are often aware of the primary documents that engineers write while in their professional careers, but they do not typically emphasize the same types of documents in their classes. The reasons for disparity between workplace requirements and technical writing classes are not clear, but there are various avenues that should be explored to help determine why the gap exists and how to close it.

The first thing that we must remember is that most technical writing instructors are not trained in engineering. While schools are depending on technical writing instructors to teach engineering students the necessary skills to effectively communication in their future professional careers, those technical writing instructors typically have no engineering experience, so they do not have the background to bring real-life examples from the engineering field. In addition, the instructors are typically in departments outside of the college of engineering, but rather English or communication departments. As a result, the instructors have limited access to engineering faculty, making it difficult to get feedback and suggestions from others who are familiar with the demands of professional engineering.

In addition to limited experiences with engineering, many instructors asked to teach introductory technical writing, technical communication, or professional writing classes do not have experience in technical writing, either professionally or academically. Rather, they are often English professors (sometimes with a specialty in literature) who were asked to teach introduction to technical writing class. When instructors are asked to teach a subject that is out of their area of expertise, they often fall back to assignments that they are comfortable with. For composition professors, this comfort level includes standard research documents, such as technical proposals, which resemble the research proposal that most academics have experience producing and reading. So it makes sense that the proposal would be a common assignment in technical writing classes taught by professors with limited experience in technical writing. Although the research from this study did not provide evidence that the instructors had limited experience in technical writing, it is a consideration that should be explored to determine how heavily the academic and professional background of the technical writing instructor affects the assignments required for completion of the course.

Another consideration when exploring the limitations of assignments in the technical writing classroom is that many instructors are not aware of the professional business standards.

While some professors have personal experience working in the corporate world, many do not. Instead, they took a direct path from undergraduate to graduate school, ending with a job at a college or university. So the professors do not have experience working in a corporation, which has different approaches and procedures than academia. Instructors are asked to prepare students for future careers, but they may not be aware of the intricacies of those careers, especially when the future career is outside of the research field of the professor, as engineering is for many instructors of technical communication. This lack of experience can limit the professors' ability to create assignments that parallel the reading and writing that the students will do in their future careers. It appears, for example, that instructors of technical writing are unaware of the importance of meeting minutes in professional engineering settings. It is possible that this misunderstanding is not limited to instructors of technical writing, but rather is applicable to many fields.

Of course, if the instructors have no engineering experience and little-to-no technical writing experience, it can be concluded that most instructors do not have access to engineering documents, which would present a problem with getting students to read sample documents for analysis. Instructors are often limited to sample documents provided by the textbook, which are not necessarily from the field, especially considering that the textbooks are seldom written by engineering professionals. If the instructors do not have access to documents that engineers typically use in their professional careers, they are limited in what they can require students to read. In order to combat this issue, instructors of technical writing, technical communication, and professional writing would benefit from being reaching out to a professional engineer, or at the very least, a professor of engineering, to help identify and provide material for students to read and analyze in their technical writing classes.

For those instructors with limited access to real-world sample documents, the textbook is often used as the primary source for course materials. The textbook can easily become the leading source for course design. There are a few problems with this approach. The primary issue is the intended textbook audience. Technical writing survey textbooks are designed to work for a variety of majors, from liberal arts degrees such as English and history to STEM fields like engineering and biology. Because the books are not specifically designed for engineering majors, it is not logical for the textbooks to include engineering-specific documents. But the lack of sample documents specific to the field makes it difficult for instructors to provide reading material that resembles the material students will read in their future careers, and it makes it difficult for instructors to design courses that have assignments that resemble the writing done by professional engineers. In addition, the textbook authors are seldom professional engineers, which again is logical based on the intended audience of the textbooks. But the lack of engineering background can be detrimental when the technical writing classes are the primary course for teaching future engineers the necessary writing skills.

4.5 Pedagogical Recommendations

Instructors of technical writing, technical communication, and professional writing are charged with preparing students for the reading and writing requirements of their future careers, but they don’t always appear to approach the class as a tool to teach necessary skills for the profession. While the instructors do have a decent understanding of the reading and writing requirements in professional engineering, they do not apply that knowledge as they design the technical writing classes. Instructors must adjust their course curriculums to teach the types of writing that are used in professional engineering. This adjustment needs to be made in two distinct areas: reading and writing.

4.5.1 Incorporating More Reading in the Technical Writing Classroom

As instructors, we are clearly aware that engineers spend a good bit of their professional day reading specific documents, such as correspondence and technical reports. However, we don't emphasize the reading of those same documents in our classes. And while some might argue that instructors actually do require reading technical documents in their professional writing classes and those elements are just not emphasized on the syllabus because they do not have specific assignments connected to the reading requirements, the truth is that the instructors themselves admit that they do not weigh reading very heavily in their classes. And this practice is not uncommon in composition classrooms. When Michael Bunn asked composition instructors if they view reading and writing as connected activities, all the instructors who answered the question responded yes; but the same instructors admitted that they do not all teach the connection between reading and writing to their students. This trend continues in the technical communication classroom, as indicated by the data from this research project. Instructors are clearly aware of the reading requirements of professional engineers, but they do not mandate or even provide opportunities for their students to read the types of documents that will be required in their future professional careers.

Obviously, there is a disconnect between what we as instructors know and what we are practicing in the technical writing classroom. We are aware that reading is essential as part of composition pedagogy. The connection between reading and composition is so compelling that in 2012, the SIG was formed at CCCC to study "The Role of Reading in Composition Studies." The WPA also acknowledges this connection by including reading in the Writing Program Administrators Outcomes Statement. Not only does WPA provide outcomes categorized as "Critical Thinking, Reading, and Composing," but the organization also calls for faculty to teach students “strategies for reading a range of texts in their fields” (WPA). The standards are set for first year composition, classes that typically have a range of majors and interests. Yet when technical communication instructors have a class that is geared towards a specific discipline – something most composition classes do not have the advantage of – we do not emphasize reading technical documents, the very documents that the future engineers will read in their professional careers.

While there are different logical reasons for the lack of reading in technical writing classes, as instructors of technical writing, technical communication, and professional writings, we must change the reading requirements in our classes. To make positive changes for our students, we have an obligation to incorporate reading relevant to engineering into our classes. Including reading in our technical writing classes will benefit the students in multiple ways; primarily, students will learn how to read technical documents, something that is not currently taught to potential engineers. Students are not typically exposed to technical documents in other composition classes. Instead, first year composition students are exposed to academic essays, narratives, and multimodal writing. But engineers are required to read different types of documents in their careers, such as technical reports, management reports, and proposals. Since students are not exposed to technical documents in other composition classes, much less taught to read the documents, it is important that we as instructors of technical writing take the time to teach students the differences between standard academic and technical writing. And the best way to illustrate the differences between the types of writing is to emphasize reading and evaluation of the documents.

Reading also helps students understand the writing process for technical documents because it forces them to become members of the audience. Readers must work to understand the meaning and organization of documents, and as they do, they start to identify the characteristics of writing that are effective in technical documents but that may not be as effective in the traditional academic writing the students have previously been exposed to. When students look at information from the lens of the audience, they are better able to understand the intricacies that technical writing requires for effective communication, and, as a result, apply those characteristics to their own writing. Instead of writing only as the writer, the student writes as someone who understands and appreciates the audience, a skill that is often missing in professional engineers' writing.

Also, by including reading in our classes, we can help students understand that their writing is not a stand-alone process. While the technical documents are not considered part of the academic conversation, they are part of the professional engineering conversation, a conversation that our students would benefit from learning since they will be expected to be members of that very conversation when they graduate. As Alder-Kassner and Estrem conclude, "to produce a successful reading, readers must engage in a dialogue between genre conventions and their ideas" (37). We cannot expect students to understand the dialogue, much less be active participants, if they are not required to read the technical documents used to convey the substance of the discussion.

4.5.2 Improving Writing of Technical Writing Students

The purpose of technical communication, technical writing, and professional writing classes is to prepare students for their professional careers. Unlike freshman survey courses designed to expose students to literature, history, or psychology, the technical writing classes have a distinct purpose and student body. Typically, technical communication courses are usually offered to engineering or science majors (Yeats and Thompson). As such, the classes have specific objectives to improve students' understanding of the necessary techniques to effectively communicate in their future STEM careers. Of course, to prepare students for the demands of their future careers, instructors of technical writing, technical communication, and professional writing classes must have a clear understanding of what the demands of professional engineering are.

Fortunately, instructors have a fairly clear understanding of the time engineers spend writing certain types of communication, especially correspondence; however, their perceptions of what engineers do are not adequately reflected in their course assignments. Technical writing, technical communication, and professional writing instructors need to work to better align course writing assignments with the writing that engineers will do in their careers. While the first thought is to add more assignments, it is not always feasible. As we are all well aware, in a one-semester class, it is impossible to assign every time of writing that engineers do. There simply is not enough time, and if one were to try such a feat, it would result in incredible frustration for both the students and the instructor. But that doesn't mean that instructors cannot teach a variety of writing types to technical communication students. There are other options the instructors can consider to help students learn the fundamental skills of writing documents specific to the engineering profession.

One key is for instructors to identify transferable skills. As noted earlier, the engineers I contacted made it clear that technical reports have enough details that the project can be replicated. Of the six document types discussed in this study, a technical report is not the only type that provides such details. Manuals also work to provide the reader with enough details to complete a process. Instructors can teach one of the document types and then spend time teaching the connections between the two. Having students write a technical report and then evaluate a manual will provide students with the tools to understand the connection between the two works and to identify what aspects of the technical report are present in the manual. Students can learn the basics of both types of writing without having to compose two time-intensive assignments.

Evaluation and analysis are also important techniques that can be used to teach different genres of technical writing. Instructors often require students to read sample documents of the type of writing the students will be required to do in the class. However, students can also read and analyze document types that they will not write. Requiring students to analyze a document requires the students to read the document at a different level. The students must consider, among other things, the message, the audience, the formatting, and the medium, all elements of technical communication. A comprehensive analysis assignment will do more than teach students to read a work; it will also provide information about the readability of the document that can be applied to future writing. Again, the instructor must work to connect the different ideas. Providing feedback that connects the evaluation to another course writing assignment is essential. Instead of saying the evaluation was well done, the instructor needs to push the student to the next level by asking, “How can you use what you learned from analyzing this document when you compose your next writing assignment for this course?”

Finally, some small writing techniques can be embedded in other, larger writing assignments. Fortunately, correspondence is the easiest to incorporate into other writing assignments, which is relevant because it is also the type of writing that engineers say they do most often on the job. Correspondence can be included with a proposal assignment by requiring students to write a cover letter introducing their proposal. Instructors can require students to send emails introducing themselves at the start of the semester. When I used service learning in my technical writing class, I had students send an email to introduce themselves to the contact person for their organization. Because the students had not previously met the contact person, the email was the first impression the contact had of the student, and the students took the assignment seriously with most even participating in an optional peer review of the emails before they were sent. Meeting minutes can also be embedded by making minutes a required element of a collaborative project. In addition, evaluation and analysis can be added to the meeting minutes assignment; one student is required to take minutes at a team meeting and the other students are required to provide feedback on the content, the writing, and the formatting. Naturally, the team members can take turns recording the meeting minutes.

4.6 Future Implications

This study exploring the connection between the technical writing classroom and the reading and writing demands of professional engineers clearly shows that there are deficiencies in workplace application of classroom assignments in technical writing, technical communication, and professional writing pedagogy. However, there are areas for future research, especially as we work to determine the best approaches to ensuring that what is taught in the technical writing classroom actually meets the demands that our students will face in their future careers as professional engineers.

The first area of future research is to explore in more detail the concerns that this study identified. One key area of research is transferrable skills. While the instructors report that they do not teach certain document types, like reading and writing meeting minutes, the question remains how many of the concepts that are taught are applicable to meeting minutes. For example, many instructors require collaborative assignments. When part of the collaborative assignment is for the teams to submit notes of the project plan, details of the team contract, outlines of progress, and reviews of peers, the skills may transfer to other types of documentation. When team members are asked to submit periodical outlines of progress, the students are often creating documents that have qualities similar to meeting minutes. The project plan and team contract both contain elements that can be found in technical reports and proposals. The idea of transferability is important because it is virtually impossible to teach every document that students will face in their future careers. A bigger, more important key is to teach skills that the students can transfer to multiple areas of their professional careers. Research can be done to help identify the relevance of the assignments that are commonly given in technical writing, technical communication, and professional writing classes and determine how the skills to create those assignments can be applied to other documents and situations in professional engineering.

Another future area of research is to consider how much the textbooks influence the course design of technical writing classes, especially for instructors with limited experience in technical writing. While this research does not need to be limited to technical writing classes, it would be an interesting study to determine how the experience of instructors in technical writing relates to dependency on the textbook for course design in introductory technical communication courses. To relate the research to this study, it would serve as a way to help determine instructors' motivation for highlighting specific assignments, such as proposals. Now that we have research showing what assignments are common in technical writing, technical communication, and professional writing classes, we can work to determine the influence of textbooks on course design.

In addition, the syllabi and assignment prompts indicated that instructors often assign multimodal work in their technical writing classes. There is little research on how often engineers write using multimodal technology in their professional jobs, which would be an interesting area to explore to determine the workplace relevance of the assignments. As the world of communication is changing and becoming more reliant on technology, the role of multimodal assignments may be changing as well. Along those lines, a study considering the motivation to include multimodal assignments would help determine if the push is coming from the world of technical writing or from rhetoric and composition pedagogy that is then being applied to technical writing classes.

WORKS CITED

Abbott, C. "(Re)connecting theory and practice: Academics collaborating with workplace professionals—The NIU/Chicago chapter STC institute for professional development" *Innovative Approaches to Teaching Technical Communication*. Bridgeford, Tracy, Karla Saari Kitalong, and Dickie Selfe, eds. Logan: Utah State University Press, 2004. Print.

ABET. *Criteria for Accrediting Engineering Programs, 2012 - 2013*. (2011) 17 July, 2015 Retrieved from http://www.abet.org/DisplayTemplates/DocsHandbook.aspx?id=3143

ABET, *History* ABET. Web. 22 October, 2015. Retrieved from http://www.abet.org/about-abet/history/

Adler-Kassner, Linda, and Heidi Estrem. "Reading Practices in the Writing Classroom." *WPA* 31.1/2 (2007):35-47.

Aldridge, M.D., and K. Cryer. "ABET And IEEE: A History Intertwined." *2009 IEEE Conference On The History Of Technical Societies* (2009): 1.

Bang, Hee Jin. "Reliability Of National Writing Project's Analytic Writing Continuum Assessment System." *Journal Of Writing Assessment* (2013): 13-24.

Borrego, Maura, and Lynita K. Newswander. "Characteristics of Successful Cross-Disciplinary Engineering Education Collaborations." *Journal of Engineering Education* 97.2 (2008): 123-134.

Bourelle, Tiffany. "Bridging the Gap between the Technical Communication Classroom and the Internship: Teaching Social Consciousness and Real-World Writing." *Journal of Technical Writing and Communication* 42.2 (2012): 183-97. Print.

Bradley, Dilger. *Welcome to the New ATTW-L*. ATTW, 20 November 2015. Web. November 20, 2015.

Bunn, Michael. "Motivation And Connection: Teaching Reading (And Writing) In The Composition Classroom." *College Composition And Communication* 64.3 (2013): 496-516.

Buzzi, Olivier, Susan Grimes, and Alistair Rolls. "Writing For The Discipline In The Discipline?." *Teaching in Higher Education* 17.4 (2012): 479-484.

Cunningham, Don, and Jill Stewart. "Perceptions and Practices: A Survey of Professional Engineers and Architects." *ISRN Education* (2012): 1.

Darling, Ann L., and Deanna P. Dannels. "Practicing Engineers Talk About The Importance Of Talk: A Report On The Role Of Oral Communication In The Workplace." *Communication Education* 52.1 (2003): 1.

Deans, Thomas. *Writing Partnerships: Service-Learning in Composition*. 2000. Print.

Downing, Craig G. "Essential Non-Technical Skills for Teaming." *Journal of Engineering Education* 90.1 (2001): 113-117.

Gimenez, J., and J. Thondhlana. "Collaborative Writing in Engineering: Perspectives from Research and Implications for Undergraduate Education." *European Journal of Engineering Education* 37.5 (2012): 471-487.

"History ATTW." Association of Teachers of Technical Writing. Web. 14 Nov. 2015.

Huckin, Thomas N. "Technical Writing and Community Service." *Journal of Business and Technical Communication* 11.1 (1997): 11.

Johnson-Eilola, Johndan. "Relocating The Value Of Work: Technical Communication In A Post-Industrial Age." *Technical Communication Quarterly* 5.3 (1996): 245-70.

Kassim, Hafizoah, and Fatimah Ali. "English Communicative Events and Skills Needed at the Workplace: Feedback from the Industry." *English for Specific Purposes* 29. (2010): 168-182.

Kohn, Liberty. "How Professional Writing Pedagogy And University–Workplace Partnerships Can Shape The Mentoring Of Workplace Writing." *Journal Of Technical Writing & Communication* 45.2 (2015): 166-188.

Landrum, R. Eric. "Are There Instructional Differences Between Full-Time and Part-Time Faculty?." *College Teaching* 57.1 (2009): 23-26.

Lanier, Clinton R. "Analysis Of The Skills Called For By Technical Communication Employers In Recruitment Postings." *Technical Communication* 56.1 (2009): 51-61.

Lappalainen, Pia. "Communication as Part of The Engineering Skills Set." *European Journal of Engineering Education* 34.2 (2009): 123-129.

Lattuca, Lisa R., P.T. Terenzini, and J.F. Volkwein. *Engineering Change: A study of the impact of EC2000. Executive Summary* (2006).

Library of Congress, “Thirty-Seventh Congress. Sess II. Ch. 129, 130” *A Century of Lawmaking for a New Nation: U.S. Congressional Documents and Debates, 1774 – 1875*. Library of Congress. Web. 23 October, 2015.

Linsdell, Jeanne, and Thalia Anagnos. "Motivating Technical Writing through Study of the Environment." *Journal of Professional Issues In Engineering Education & Practice* 137.1 (2011): 20-27.

Măgdoiu, Liliana Doina, et al. "Research on Management And Communication In Economic Engineering." *Journal Of Electrical & Electronics Engineering* 3.1 (2010): 119-122.

Magleby, S.P., C.D. Sorensen, and R.H. Todd. "Integrated Product And Process Design: A Capstone Course In Mechanical And Manufacturing Engineering." *Proceedings Frontiers In Education Twenty-First Annual Conference Engineering Education In A New World Order* (1991): 469.

Maharaj, S., & Banta, L. (2000). Using log assignments to foster learning: Revisiting writing across the curriculum. *Journal of Engineering Education*. (89)1, 73-78.

Matthews, Catherine, and Beverly Zimmerman. "Integrating Service Learning and Technical Communication: Benefits and Challenges." *Technical Communication Quarterly* 8.4 (1999): 383. Print.

McKee, Candie DeLane. "Information Design: A New Approach to Teaching Technical Writing Service Courses." *ProQuest* LLC (2012).

Meloncon, Lisa, and Peter England. "The Current Status of Contingent Faculty in Technical and Professional Communication." *College English* 73.4 (2011): 396-408.

Nienkamp, Paul. "Land-Grant Colleges and American Engineers." *American Educational History Journal* 37.1/2 (2010): 313-330.

Orr, Thomas, and Aizuwakamatsu (Japan). Center for Language Research. Aizu Univ. *Designing English Writing Instruction For Students In The Science And Technologies: Research, Results, And Applications*. Technical Report 96-5-001. n.p.: 1996.

Ostheimer, Martha W., and Edward M. White. "Portfolio Assessment in an American Engineering College." *Assessing Writing* 10. (2005): 61-73.

Parr, Damian, et al. "Designing Sustainable Agriculture Education: Academics' Suggestions For An Undergraduate Curriculum At A Land Grant University." *Agriculture & Human Values* 24.4 (2007): 523-533.

Perelman, Les. "Data Driven Change Is Easy; Assessing And Maintaining It Is The Hard Part." *Across The Disciplines: Interdisciplinary Perspectives on Language, Learning, And Academic Writing* [Supplement] (2009): *MLA International Bibliography*.

Plumb, Carolyn, and Cathie Scott. "Outcomes Assessment of Engineering Writing at the University Of Washington." *Journal of Engineering Education* 91.3 (2002): 333-338.

Poe, Mya, Neal Lerner, and Jennifer Craig. *Learning to Communicate in Science and Engineering: Case Studies From MIT*. Cambridge, Mass.: MIT Press, 2010.

Prados, John W., George D. Peterson, and Lisa R. Lattuca. "Quality Assurance of Engineering Education Through Accreditation: The Impact of Engineering Criteria 2000 and its Global Influence." *Journal of Engineering Education* 94.1 (2005): 165-184.

Randolph, Gary B. "Collaborative Learning in the Classroom: A Writing Across the Curriculum Approach." *Journal of Engineering Education* 89.2 (2000): 119-122.

Ravesteijn, Wim, Erik de Graaff, and Otto Kroesen. "Engineering the Future: The Social Necessity of Communicative Engineers." *European Journal of Engineering Education* 31.1 (2006): 63-71.

Reave, Laura. "Technical Communication Instruction in Engineering Schools: A Survey of Top-Ranked U.S. And Canadian Programs." *Journal of Business & Technical Communication* 18.4 (2004): 452-490.

Richter, David M., and Marie C. Paretti. "Identifying Barriers To and Outcomes of Interdisciplinarity In The Engineering Classroom." *European Journal of Engineering Education* 34.1 (2009): 29-45.

Sageev, Pneena, and Carol J. Romanowski. "A Message From Recent Engineering Graduates in the Workplace: Results of a Survey on Technical Communication Skills." *Journal of Engineering Education* 90.4 (2001): 685-693.

Scott, J. Blake. "Rearticulating Civic Engagement through Cultural Studies and Service-Learning." *Technical Communication Quarterly* 13.3 (2004): 289-306. Print.

Smelser, Ron E. "How to Build Better Engineers: A Practical Approach to the Mechanics of Text." *The Quarterly* Fall 2001: 32-40.

Steiner, Derek G. "The Communication Habits Of Engineers: A Study Of How Compositional Style And Time Affect The Production Of Oral And Written Communication Of Engineers." *Journal of Technical Writing & Communication* 41.1 (2011): 33-58.

Swain, Sherry Seale, and Paul LeMahieu. "Assessment In A Culture Of Inquiry: The Story Of The National Writing Project's Analytic Writing Continuum." *Writing Assessment in the 21st Century: Essays in Honor of Edward M. White*. 45-67. New York, NY: Hampton, 2012.

Todd, Robert, and Spencer Magleby. "Elements of A Successful Capstone Course Considering The Needs Of Stakeholders." *European Journal of Engineering Education* 30.2 (2005): 203-214.

Tryggvason, Gretar, et al. "The New Mechanical Engineering Curriculum at the University of Michigan." *Journal of Engineering Education* 90.3 (2001): 437-444.

Whiteman, Wayne E. "The Impact Of EC2000 On Mechanical Engineering Curricula: A Follow-Up Study." *International Journal Of Mechanical Engineering Education* 39.3 (2011): 185-194.

Williams, Julia M. "The Engineering Communication Portfolio: Writing, Reflection, and Technical Communication Assessment." *IPCC 2001. Communication Dimensions. Proceedings IEEE International Professional Communication Conference (Cat. No.01CH37271)* (2001): 341.

---. "Transformations in Technical Communication Pedagogy: Engineering, Writing, And The ABET Engineering Criteria 2000." *Technical Communication Quarterly* 10.2 (2001): 149.

WPA. "WPA Outcomes Statement for First-Year Compostion (v3.0) (adopted 17 July 2014)" WPA Council. Retrieved from http://wpacouncil.org/positions/outcomes.html.

Yeats, Dave, and Isabelle Thompson. "Mapping Technical and Professional Communication: A Summary and Survey of Academic Locations for Programs." *Technical Communication Quarterly* 19.3 (2010): 225-261.

APPENDICES

Appendix A (Informed Consent)

Georgia State University

Department of English

Informed Consent

Title: Teaching Engineers to Write: A Study on Current Pedagogy Effectiveness for Work-Place Application

Principal Investigators: Lynée Lewis Gaillet

Student Principal Investigator: Ann Marie Francis

I. Purpose:

You are invited to participate in a research study. The purpose of this research project is to explore how well technical communication classes prepare students for writing demands in professional engineering jobs You are invited to participate because you have taught a college-level technical communication or technical writing class in the past two years. A total of 50 participants will be recruited for this study. Participation in the one-time survey should require no more than 20 minutes of your time.

II. Procedures:

If you decide to participate, you will complete an online survey. The online survey, which should take no more than 20 minutes of your time, will ask questions about what types of writing you believe engineers do in their professional careers, what types of assignments you require in your technical writing classes, and what qualities you look for when you grade assignments. At the end of the survey, you will have the option of providing a sample syllabus and/or sample assignment prompts.

The online survey will be completed at your convenience. You will not have personal interaction with any of the researchers and will not be asked to do anything additional once the survey is complete.

III. Risks:

In this study, you will not have any more risks than you would in a normal day of life.

IV. Benefits:

Participation in this study may not directly benefit you personally. However, the research from this study may lead to additional resources for teaching technical communication classes. Overall, we hope to gain insight on how adapt current technical writing pedagogy to best meet the writing demands engineering students will face in their future careers.

V. Voluntary Participation and Withdrawal:

Participation in research is voluntary. You do not have to be in this study. If you decide to be in the study and change your mind, you have the right to drop out at any time. You may skip questions or stop participating at any time. Whatever you decide, you will not lose any benefits to which you are otherwise entitled.

VI. Confidentiality:

We will keep your records private to the extent allowed by law. Lyneé Lewis Gaillet and Ann Marie Francis will have access to the information you provide. Information may also be shared with those who make sure the study is done correctly (GSU Institutional Review Board, the Office for Human Research Protection (OHRP)). The survey data will be collected anonymously, but you should be aware that data sent over the Internet may not be secure. If you feel that your connection is not secure and your information may be jeopardized, you should not participate.

The information you provide will be stored on a password-protected computer with a separate password for the file. Your name and other facts that might point to you will not appear when we present this study or publish its results. The findings will be summarized and reported in group form. You will not be identified personally.

VII. Contact Persons:

Contact Lyneé Lewis Gaillet at 404-413-5842 or lgaillet@gsu.edu and/or Ann Marie Francis at 470-239-3116 or afrancis9@student.gsu.edu if you have questions, concerns, or complaints about this study. You can also call if you think you have been harmed by the study. Call Susan Vogtner in the Georgia State University Office of Research Integrity at 404-413-3513 or svogtner1@gsu.edu if you want to talk to someone who is not part of the study team. You can talk about questions, concerns, offer input, obtain information, or suggestions about the study. You can also call Susan Vogtner if you have questions or concerns about your rights in this study.

VIII. Copy of Consent Form to Participant:

You can print a copy of this consent form to keep for your records.

If you are willing to volunteer for this research, please indicate below by clicking the continue button to continue with the survey.

Appendix B (Survey)

Do you agree to participate in this study?

☐ Yes ☐ No

Are you at least 18 years of age or older?

☐ Yes ☐ No

Do you teach classes at a college or university in the United States?

☐ Yes ☐ No

Have you taught at least one technical communication class in the last two years?

☐ Yes ☐ No

In your opinion, how much time do engineers spend doing the following tasks in their professional jobs?

☐ Very Rarely ☐ Rarely ☐ Neutral ☐ Often ☐ Very Often ☐ N/A

Reading correspondence (letters, emails, memos, faxes)

Reading meeting minutes

Reading technical reports

Reading management reports

Reading proposals

Reading manuals

Evaluating documents

Writing correspondence (letters, emails, memos, faxes)

Writing meeting minutes

Writing technical reports

Writing management reports

Writing proposals

Writing manuals

Editing other people's writing

Based on your personal experience, how heavily are the following activities/assignments weighed in your technical communication classes?

☐ Very Little ☐ Little ☐ Neutral ☐ Heavily ☐ Very Heavily ☐ N/A

Reading correspondence (letters, emails, memos, faxes)

Reading meeting minutes

Reading technical reports

Reading management reports

Reading proposals

Reading manuals

Evaluating documents

Writing correspondence (letters, emails, memos, faxes)

Writing meeting minutes

Writing technical reports

Writing management reports

Writing proposals

Writing manuals

Editing other people's writing

When answer the following questions, please consider how you grade assignments in your technical communication classes. Pick one of the choices to rate the following statements.

☐ Very Trivial ☐ Trivial ☐ Neutral ☐ Crucial ☐ Very Crucial

Technical documents should cover topic with appropriate and proper detail.

Technical documents should use precise language to express meaning.

Technical documents should provide a true understanding and representation of the subject.

Technical documents should use simple, direct language.

Technical documents should be grammatically correct.

Technical documents should describe information's importance and implications.

Technical documents should not have misspelled words.

What is your job title?

☐ Adjunct (PT) ☐ FT-Non-Tenure Track ☐ Assistant Professor

☐ Associate Professor ☐ Full Professor ☐ Other

If "other" please indicate: ___________________

What is your highest level of education?

☐ MA ☐ MFA ☐ EdD ☐ PhD ☐ Other

If "other" please indicate: ___________________

What is the discipline of your highest degree?

☐ English ☐ Professional/Technical Writing ☐ Rhetoric/Composition

☐ Communication ☐ Engineering ☐ Other

If "other" please indicate: ___________________

At what type of institution do you teach?

☐ 2-year college ☐ 4-year college ☐ university (grants graduate degrees)

Is the institution public or private?

☐ public ☐ private, non-profit ☐ private, for-profit

Does your college or university offer engineering degrees?

☐ Yes ☐ No

Are you willing to provide a copy of your syllabus for your technical writing, technical communication, or professional writing class? (Answering NO will not affect your responses or lessen the usefulness of your participation.).

☐ Yes ☐ No

If yes, direct to a place to upload with the following instructions.
Please upload a sample syllabus for a technical writing, technical communication, or professional writing class you have taught in the past two years. Before uploading the syllabus, please remove any identifying information, such as name, school, address, office location, email, and phone number.

Are you willing to provide sample assignment prompts from your technical communication, technical writing, or professional writing classes? (Answering NO will not affect your responses or lessen the usefulness of your participation.).

☐ Yes ☐ No

If yes, direct to a place to upload with the following instructions.
Please upload sample assignment prompts for a technical communication, technical writing, or professional writing class you have taught in the past two years. Before uploading the document, please remove any identifying information, such as name, school, address, office location, email, and phone number.

Are you willing to provide sample rubrics from your technical communication, technical writing, or professional writing class? (Answering NO will not affect your responses or lessen the usefulness of your participation.).

☐ Yes ☐ No

If yes, direct to a place to upload with the following instructions.
Please upload sample rubrics for a technical communication, technical writing, or professional writing class you have taught in the past two years. Before uploading the document, please remove any identifying information, such as name, school, address, office location, email, and phone number.

Appendix C (Emails)

Appendix C.1 (First Email)

Dear ATTW Listserv Members,

We would like to invite you to participate in a research study that will explore how well the pedagogical practices of technical communication instructors match the needs of professional engineers. This study is open to all college-level instructors who have taught at least one section of technical communication, technical writing, or professional writing in the last two years.

If you decide to participate, you will be asked to respond to an online survey regarding your ideas of what types of writing engineers do in their professional careers, what constitutes quality writing, and what types of assignments you require in your courses. At the end of the survey, you will have the option of attaching a sample syllabus, assignment prompts, and rubrics. The additional documents are not required for participation. The survey should take no longer than 15 minutes of your time.

This research study has been approved by Georgia State University's Institutional Review Board, and you will be asked to read and agree to an informed consent at the beginning of the survey. You may decline to participate or withdraw from the study at any time.

The link to the survey can be found here:

https://gsu.qualtrics.com/SE/?SID=SV_9SPPyxj3v594HQh

Thank you in advance for considering participating in our study, and please do not hesitate to contact us via email (lgaillet@gsu.edu and afrancis9@student.gsu.edu) in advance if you have any questions or concerns.

Sincerely,

Dr. Lynée Lewis Gaillet, Professor of English, GSU

Ann Marie Francis, PhD Candidate, GSU

Appendix C.2 (Second Email)

All,

We are still collecting surveys for our research on the attitudes and pedagogical practices of instructors of technical writing. We invite all members of the listserv who have taught at least one section of technical communication, technical writing, or professional writing in the last two years to participate if you haven't already. For more details, see message below.

Follow this link to access the survey.

https://gsu.qualtrics.com/SE/?SID=SV_9SPPyxj3v594HQh

Thanks to all who have already responded.

Ann Marie Francis (afrancis9@student.gsu.edu)

Lynée Lewis Gaillet (lgaillet@gsu.edu)

FW: Technical Writing Instructor Survey

Dear ATTW Listserv Member,

We would like to invite you to participate in a research study that will explore how well the pedagogical practices of technical communication instructors match the needs of professional engineers. This study is open to all college-level instructors who have taught at least one section of technical communication, technical writing, or professional writing in the last two years.

If you decide to participate, you will be asked to respond to an online survey regarding your ideas of what types of writing engineers do in their professional careers, what constitutes quality writing, and what types of assignments you require in your courses. At the end of the survey, you will have the option of attaching a sample syllabus, assignment prompts, and rubrics. The additional documents are not required for participation. The survey should take no longer than 15 minutes of your time.

This research study has been approved by Georgia State University's Institutional Review Board, and you will be asked to read and agree to an informed consent at the beginning of the survey. You may decline to participate or withdraw from the study at any time.

The link to the survey can be found here: https://gsu.qualtrics.com/SE/?SID=SV_9SPPyxj3v594HQh

Thank you in advance for considering participating in our study, and please do not hesitate to contact us via email (lgaillet@gsu.edu and afrancis9@student.gsu.edu) in advance if you have any questions or concerns.

Sincerely,

Dr. Lynée Lewis Gaillet, Professor of English, GSU

Ann Marie Francis, PhD Candidate, GSU

Appendix C.3 (Third Email)

All,

Thank you to everyone who has already responded to our survey on pedagogical practices of technical communication instructors. We are closing out the survey on Wednesday, November 18. If you haven't already responded and are willing to do so, we would greatly appreciate it.

Follow this link to access the survey.

https://gsu.qualtrics.com/SE/?SID=SV_9SPPyxj3v594HQh

Again, thanks to all who have already responded.

Ann Marie Francis (afrancis9@student.gsu.edu)

Lynée Lewis Gaillet (lgaillet@gsu.edu)

FW: Technical Writing Instructor Survey

Dear ATTW Listserv Member,

We would like to invite you to participate in a research study that will explore how well the pedagogical practices of technical communication instructors match the needs of professional engineers. This study is open to all college-level instructors who have taught at least one section of technical communication, technical writing, or professional writing in the last two years.

If you decide to participate, you will be asked to respond to an online survey regarding your ideas of what types of writing engineers do in their professional careers, what constitutes quality writing, and what types of assignments you require in your courses. At the end of the survey, you will have the option of attaching a sample syllabus, assignment prompts, and rubrics. The additional documents are not required for participation. The survey should take no longer than 15 minutes of your time.

This research study has been approved by Georgia State University's Institutional Review Board, and you will be asked to read and agree to an informed consent at the beginning of the survey. You may decline to participate or withdraw from the study at any time.

The link to the survey can be found here:

https://gsu.qualtrics.com/SE/?SID=SV_9SPPyxj3v594HQh

Thank you in advance for considering participating in our study, and please do not hesitate to contact us via email (lgaillet@gsu.edu and afrancis9@student.gsu.edu) in advance if you have any questions or concerns.

Sincerely,

Dr. Lynée Lewis Gaillet, Professor of English, GSU

Ann Marie Francis, PhD Candidate, GSU

Appendix D

Appendix D.1 (Content Criteria)

Content Criteria

- You identify the project with enough clarity and detail for the readers to visualize the site
- Ideas are clear and interesting
- Content is thoroughly covered
- Creative, interesting, and realistic proposal topic
- Thorough coverage of details
- Main points are addressed and fully supported
- Content is relevant
- Makes use of multiple forms of evidence showing awareness of value of evidence
- Claims are nuanced, perhaps by qualifiers
- Evidence shows ability to management multiple sources
- Justification provides strong connection
- Introduction and structure improve readability and aid understanding
- Claims are supported by evidence, examples, etc.
- Adequately addresses the topic
- Recognizes other contributions to the discussion
- Clear statement of what information the message contains and why it is important
- Content is accurate, comprehensive, relevant, and supported claims
- Document is accurate and comprehensive
- Document contains relevant information
- Claims are supported with effective evidence

- Research is from reliable sources
- Spells out the limits and scope of the proposal
- Establishes the magnitude of the problem to be solved
- Connects the problem to similar problems identified in a survey of literature, using multiple forms of detailed, appropriate, and well-documented evidence
- Includes complexity of thought as well as credible and numerous sources of information

Appendix D.2 (Structure Criteria)

Structure Criteria

- Arranges parts logically
- Follows structural conventions for the genre
- The assignment is concisely written
- The memo is logically organized
- Paragraphs contain topic sentences and are well supported
- Headings are descriptive and appropriate to the content
- Paragraph structure strengthens the clarity of ideas
- Sustains main idea through a logical progression of supporting points
- Information is "chunked" in ways that make sense
- Document organization is effective and logical throughout
- It is easy to read and understand
- Information is easy to locate and scan
- Briefly outlines the plan and suggests the organization of the rest of this document
- Is well organized so that the reader can easily comprehend and find information
- The pattern of organization makes sense to the reader's comprehension and access of information
- Technical writing makes use of appropriate heading, lists (where appropriate), and transitions

Appendix D.3 (Stance Criteria)

Stance Criteria

- Excellent match of document to audience needs
- Excellent match of level of formality and technically to audience
- Ethical approach to the communication situation
- The memo is written for the general public
- The wording and style are unlikely to confuse or intimidate non-expert readers
- Content is appropriate for audience
- Takes care of the readers
- Avoids emotional appeals
- Provides enough context to leave readers comfortable with the topic's overall significance
- Excellent professional writing
- Uses active voice (unless passive voice is necessary)
- Document is written in third person
- Purpose is clearly stated
- Relevancy to topic clearly stated
- Writer appears knowledgeable
- Uses professional tone/language
- Written for primary and secondary audience(s)
- Appropriate to the audience
- Acknowledges content needs of the audience
- Appropriate for the purpose, topic, and situation

- Appropriate diction for audience
- Appropriate use of active and passive voice
- Technical writing should be precise, concise, and easy to follow

Appendix D.4 (Sentence Fluency Criteria)

Sentence Fluency Criteria

- Sentence length is appropriate
- Concise, coherent, and smooth flowing sentences
- Clear transitions between paragraph
- Sentence structure produces clear meaning
- Choices make for strong transitions and clear reading
- Provides necessary transitions
- Transitions (or signposts) are present, clear, and helpful
- Varied sentence structure

Appendix D.5 (Diction Criteria)

Diction Criteria

- Clear and succinct prose
- Gender- and culture-appropriate language
- Technical terms, processes, acronyms, and jargon are defined and used appropriately
- Avoids redundancy, ambiguity, and abstract language
- Language is appropriate for the audience (bias-free, gender-neutral, and familiar wording; no slang or clichés)
- Uses appropriate vocabulary
- Document is efficiently and appropriately worded
- Writing should not be monotonous in word choice

Appendix D.6 (Conventions Criteria)

Conventions Criteria

- No grammatical, mechanical, or typographical errors
- The memo is free of errors in spelling, grammar, and usage problems, or contains only minor errors
- Free of grammar errors
- Very few grammatical errors
- Paragraph length is appropriate
- Free from mechanical errors (grammar, punctuation, spelling, etc.)
- Paragraphs are appropriately sized
- Document contains few to no distracting composition errors (grammar, mechanics, punctuation, style, or spelling)
- There are no grammatical errors
- Points are deducted for the number of errors per page and the severity of those errors

Appendix D.7 (Other-Assignment Criteria)

Other-Assignment Criteria

- Complete and appropriate citation of sources
- Fulfills assignment precisely and fully
- Includes all parts of the assignment
- Contains all necessary parts
- Includes all major and minor elements of assignment
- No noteworthy problems with required format, sources, documentation style, and/or graphics
- Document conforms to assignment requirements
- Document contains one correctly defined formal technical term
- In-text citations and references formatted and placed correctly
- Acknowledges sources of information, ideas, quotations, images, or others "borrowings" appropriately
- Citations are used for all quotations, paraphrases, and summaries
- Both in-text citations and end references are included
- A standardized system of citation (as assigned by the instructor) has been used correctly and consistently throughout the document
- Document follows all instructions given on the assignment sheet or in class
- Format, due date, submission method, and all other elements of the assignment have been adhered to as instructed

Appendix D.8 (Other-Document Design Criteria)

Other-Document Design Criteria

- Excellent match of design elements to document genre
- Clear, readable typography
- Visually appealing
- Document design
- Formatting appropriate for genre, situation, purpose, and audience
- Appropriate use of headings/subheadings
- Document layout is professional and inviting
- There are no format errors
- Points deducted for deviations from memo format, including required elements

Appendix D.9 (Other-Visuals Criteria)

Other-Visuals Criteria

- Excellent and ethical use of graphics
- Visuals, graphic elements designed well
- Appropriate use of figures and graphics
- All visuals (pictures, graphs, tables, etc.) are clear, numbered, labeled, captioned, cited (if taken from a source), and referred to and explained in the text before they appear