

Monographs in Engineering Education Excellence

**University of South Carolina College of Engineering and Information Technology
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Edward Ernst, *University of South Carolina*, Monographs Editor

Making the Writer the Expert: The Importance of Composition and Rhetorical Theory to Writing in the Disciplines

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Preface

Monographs in Engineering Education Excellence is a series of publications dealing with innovations in engineering education introduced at the University of South Carolina, with the support of the Gateway Engineering Education Coalition. The series seeks to make the information and ideas in the reports more accessible to engineering educators. It is hoped that other institutions will find the reports useful and adaptable to their own educational mission.

The *Monographs in Engineering Education Excellence* series includes a variety of genres—theses, dissertations, and technical reports, but all have the common objective of rethinking, reshaping, and revitalizing engineering education. This monograph, *Making the Writer the Expert: The Importance of Composition and Rhetorical Theory to Writing in the Disciplines*, is a thesis written by Thomas S. Bowers in partial fulfillment of the requirements for the Master of Arts degree in English, with a specialization in Rhetoric and Composition. While he pursued this degree, Bowers was a writing consultant in the Electrical and Computer Engineering Department's Writing Center, a Gateway-supported project that has since been institutionalized as the Professional Communications Center of the University of South Carolina College of Engineering and Information Technology.

Bowers' thesis addresses a fundamental concern of engineering educators seeking ways to integrate liberal arts and engineering: what pedagogical theories justify such integration and provide guidance for creating a seamless and meaningful merger of humanities into the engineering curriculum? What theory informs our notion that such a curriculum does a better job of preparing students for their professional, ethical, and civic responsibilities?

Bowers uses the interrelatedness of theory and practice as a means of analyzing the writing of engineering students and uncovering some definitive traits of engineering communications. He brings theories of composition and rhetoric from the humanities into the context of engineering writing and identifies engineering discourse, with its emphasis on clarity, objectivity, and brevity, as a product of Current-Traditional approaches to composition. The Current-Traditional method, which arose toward the end of the nineteenth century, focuses on skills and the written product, rather than the cognitive, creative, and social processes of writing. As Bowers explains, more recent theories of composition and rhetoric view learning to write as akin to the process of socialization as the student acquires the communicative norms of the discourse community. Not only must the learners become knowledge experts in the discourse community but also their ability to communicate as experts in the community is a fundamental part of belonging to the community.

Within this theoretical context, Bowers presents a rhetorical analysis of texts written by students in a sophomore engineering class at the University of South Carolina. He uses student examples to demonstrate the process of learning to write engineering discourse as a pivotal act in learning to think and act as an engineer. According to Bowers, a theoretical perspective that incorporates contemporary and post-modern theories of rhetoric in addition to theories of technical writing and Current-Traditional methods provides a clearer understanding of students' progress in learning to write engineering texts. While acknowledging the importance of clarity, correct formats, and precise terminology, Bowers notes that an overemphasis on skills fails to recognize the student's tasks of developing an identity that conforms to the community's expectations and learning the particular ways of knowing and arguing that are valued in the profession. As Bowers concludes, a broader theoretical perspective illuminates the importance of the

connection between thought and language and students' self-conscious attempts to situate themselves within the technical community.

The Gateway Coalition takes pleasure in making Bowers' thesis more readily available to engineering colleges, as it demonstrates the wisdom of exploring the pedagogical theories in the humanities as we continue our quest to integrate humanities into the engineering curriculum.

Edward Ernst, Monographs Editor

INTRODUCTION

In the introduction to Sharon Crowley's *A Teacher's Introduction to Deconstruction*, Ross Winterowd stresses the importance of recognizing the relationship between theory and practice when it comes to the teaching of English:

Every English teacher acts on the basis of theory. Unless teaching is a random series of lessons, drills, and readings, chosen willy-nilly, the English class is guided by theories of language, literature, and pedagogy. That is, insofar as teachers choose readings and plan instruction, they are *implementing* a theory. The question, of course, is whether or not teachers understand the theory that guides instruction. If we do not understand the theoretical context in which we function, we are powerless -- unable to rationalize what we do and hence stripped of the ability to argue our case with administrators, boards of education, governments, and special interest groups such as, for example, those advocating and condemning bilingual education. (ix)

The purpose for using this quotation is to draw attention to the symbiotic relationship between theory and practice. Each element, while offering independent contributions to the teaching of writing, is also inherently dependent upon the other. Theory can inform and rationalize practice as much as practice can be used as a means to construct and validate theory. The level of dependence between these two elements and the measure of their contribution to the field of composition has been a frequent topic of debate, yet this study is not designed to promote one side over the other but to use the interrelatedness between theory and practice as a means of analyzing the writing in one particular environment. More specifically, the theories that attempt to explain the communicative process will be used as a guide to uncover some definitive traits of engineering writing with the intention of providing a more complete understanding of this particular type of communication.

Since this study arose from my desire to understand the characteristics of engineering writing more thoroughly, it is essential at this time to discuss briefly my recent experience with writing instruction in the engineering discipline. In the fall of 1997, I was hired as a writing consultant in the Electrical and Computer Engineering Writing Center at the University of South Carolina. With some background in technical writing but very little understanding of the field of engineering, I was suddenly in the position of trying to help engineering students become skilled communicators. In an era of multidisciplinary and writing-in-the-disciplines, I found myself moving from discussions of ethos and topoi in the classrooms on the humanities side of campus to conversations about Ohm's law and sine waves when I made my way to the engineering side of the university. And yet what was of most interest in the initial months and what continued to promote my intellectual curiosity as my experience progressed was the question of how the talk of ethos and topoi -- and all other conversations in the rhetoric and composition classrooms -- could be brought into the classroom discussions of Ohm's Law and sine waves. The perceived disparity I felt between composition and engineering is not something that has arisen since the inception of writing-in-the-discipline programs. The split between content and form can be traced back to Plato and other classical discussions of rhetoric, and as my experience shows, the discussion still continues. In their recent work "Writing in the Content Areas," David Kaufer and Richard Young ask

whether there is a distinction between content knowledge and writing knowledge and if these two somehow interrelate (73). Identifying a student's content knowledge can be attained through various testing methods, but how does one define this same student's writing knowledge. Is it simply a question of the student acquiring the basic skills of good grammar and following the discourse conventions of the particular discipline?

The passage by Winterowd becomes even more relevant in the context of this question. "Every English teacher acts on the basis of theory," he writes. Not only does theory guide practice, but Winterowd goes on to say that "if we do not understand the theoretical context in which we function, we are powerless -- unable to rationalize what we do." If writing instructors are to completely understand the characteristics of writing in a certain environment or discipline then they must comprehend the theoretical foundations that underlie how the discipline communicates and what the field considers to be writing knowledge. What attitudes does the discipline have toward writing, what purpose does the community assign to writing, and how is writing related to the knowledge and content generated by the community? Granted, these are rather vague questions to consider, but they form the basis by which to uncover some of the basic characteristics of how a discipline communicates and what knowledge is needed in order to successfully write within the field.

This study is an attempt to bring the theories formulated and discussed in composition and rhetoric into the context of engineering writing with the intention of providing a rich description of engineering discourse so as to investigate student attempts to participate within this discourse community. The well recognized features that have been assigned to technical writing such as clarity, conciseness, and objectivity will be discussed within the context of composition and rhetorical theory, and it will be shown that these long held traits associated with technical writing fall directly in line with the Current-Traditional approach to composition instruction. This connection thus leads to a perception that technical writing instruction is nothing more than merely providing lessons in such areas as sentence length and word choice. Not only does a Current-Traditional mode of practice suit the objectivity, definition, and philosophy basic to technical writing, it can also suit the instructor who -- due to his lack of content knowledge -- perceives that the only available source of authority is, in fact, the teaching of the basic communication skills. The distinction raised earlier between content and form can be seen quite clearly from this perspective since the writing instructor's focus is mainly on the way information is presented.

But while clarity and form may be of utmost importance to writing in the science and technology fields, the skills approach to writing and the focus on product is in direct contrast to the contemporary focus in composition theory. What this amounts to is a theoretical foundation of writing instruction -- the Current-Traditional method -- that seems inherently applicable to the engineering environment yet is frowned upon by the process centered folk within the current composition community who may be given the responsibility of teaching the writing.

In addition to the connection of Current-Traditional rhetorical theory to engineering discourse, the applicability of other contemporary rhetorical and composition theories will be explored. Of particular relevance is the increasing importance that modern rhetoric places on the social aspect of the communicative process. For example, Kenneth Burke's notions of identification and cooperation are particularly important since they represent how learning to write is akin to the process of socialization. "We are clearly in the region of rhetoric," writes Burke, "when considering the identifications whereby a specialized activity makes one a participant in some social or economic class.

'Belonging' in this sense is rhetorical" (1023). Burke further clarifies the relationship between rhetoric and social participation by stating that belonging to the community involves "striving to form oneself in accordance with the communicative norms that match the cooperative ways of his society" (1030). In order to become socialized and an accepted member of the group, one must learn the "specialized activities" of the group including the "communicative norms."

An additional insight into the significance of the social environment in relation to any communicative act can be found in Chaim Perelman's *The New Rhetoric*:

All language is the language of a community, be this a community bound by biological ties, or by the practice of a common discipline or technique. The terms used, their meaning, their definition can only be understood in the context of the habits, ways of thought, methods, external circumstances, and traditions known to the users of those terms. (1071)

In any act of communication, direct correlation exists between the language used and the external beliefs and traditions that comprise the community. In this regard, the form or the language used is a result of the values of the community. The distinction between form and content becomes a bit more cloudy with the insight offered by Perelman since the form and the language used are sanctioned by specific patterns of community -- or even disciplinary -- thought and custom.

However, within the context of community-sanctioned modes of communication, concerns arise pertaining to the status of the individual. Burke writes that the individual, in order to become identified with the group, must "strive to form oneself" as a member. If indeed communication is identification and requires subscribing to the communicative and cognitive norms of a particular group, then issues of an individual's own subjectivity come into question. In other words, how much of an individual's own mode of thought and own communicative norms have to be sacrificed in order to successfully participate and function as a member of a particular community?

In terms of engineering writing or writing in any other specific discipline, the process of socialization and identification is especially important. On one hand, students are expected to become experts in terms of subject knowledge and thus become part of the disciplinary community. However, as modern rhetorical theory stresses, not only must students become knowledge experts, but their ability to communicate this knowledge -- and in fact communicate as experts in the community -- is a fundamental part of their complete acceptance and belonging within the discipline. Students must not only know the terms and definitions of their particular discipline -- in this case, the subject matter -- they must also know the communicative norms and practices of that particular field. Learning to write within the technical discipline thus involves not only the Current-Traditional skills of clarity, conciseness, and objectivity but also the fundamental values of how arguments are constructed, how new knowledge is brought into the conversation, and how an individual's uniqueness in terms of communicative style interacts with the standardized forms of disciplinary communication. Above all, the apparent clash of individuality with community conformity with respect to language use and to patterns of reasoning as well is of utmost concern to this study.

The study will proceed in two steps. First, a description of technical writing will be developed by discussing the communicative practices of the technical and engineering community within the context of Current-Traditionalism, Expressionism, and New Rhetoric. A rhetorical analysis of a group of student texts taken from a sophomore

engineering class at the University of South Carolina will then follow. These two sections are structured on the words earlier cited by Winterowd: "Insofar as teachers choose readings and plan instruction, they are *implementing* a theory. The question is whether or not teachers understand the theory that guides the instruction." The purpose of this paper is not to offer any single mode of instruction but to provide an investigative first step that may help to understand the theory that guides engineering writing instruction. Through the use of the product -- in this case the student laboratory reports -- some insight into the overall engineering writing experience will be gained. After an understanding of the student texts, then instructors can more thoroughly assess the implementation of any method of instruction. As stated in the title of this study, the students should be made the experts in terms of their individual communicative and intellectual competence. We should not forget that they also serve as the expert informers of the texts we are trying to teach.

Chapter I

Locating Composition and Rhetorical Theory Within the World of Technical Writing

Although this study is concerned with writing in the university at the close of the twentieth century, it will prove beneficial to begin by looking back roughly 100 years in order to realize that the attitudes concerning writing instruction and the relationship between writing and the sciences are not recent phenomena but are a product of long-held beliefs. According to David Russell, the late nineteenth century is an important time period to consider in terms of writing instruction since it was then that the movement was made in higher education away from traditional oral examinations to an increased use of written papers. It was also during the late nineteenth century, Russell notes, that higher education became reorganized into specific disciplines (22). The emergence of specialized fields of study within the academy should come as no surprise since American society as a whole was undergoing similar restructuring brought about by the industrial revolution. As America moved from an agrarian society to an increased reliance on manufacturing and specialized trades, the country's workforce became identified more and more in terms of specialized skills. In order to produce a pool of laborers skilled in these particular trades, specific instruction had to be developed. In fact, a comparable transformation can be said to be occurring in American society and universities at the close of the twentieth century with the rise of such disciplines as computer engineering and information technology, fueled in part by the professed technological revolution taking place.

Yet unlike today, as disciplines emerged within the university at the end of the nineteenth century, writing instruction did not specifically address the issue of how communication was conducted within these specialized communities. As Russell states, "The role written knowledge plays in preparing students for (or excluding them from) disciplinary communities was rarely addressed systematically, either by the disciplines and the professional interests they represented or by progressive education, which itself became professionalized in education departments and public school bureaucracies" (23). Since writing instruction neglected the relationship between writing and the discipline in which it takes place, the method of instruction fell along two lines. One pedagogical approach -- Current-Traditionalism -- was designed to promote good writing in terms of the mastery of a set of prescriptive skills. Good writing was identified with the proper mechanics of writing generally associated with basic literacy skills. The second mode of instruction -- Expressionism -- was heavily influenced by creative works of literature and the perception that writing was a product of genius and personal inspiration. Developing a good writer through this pedagogical mode was done through instruction that nourished a natural gift rather than adherence to a prescribed set of rules and formulas. What was missing from the drills and skills approach and the emphasis on individual works of expression and imagination was the practice of writing within a specialized discipline. Yet even as the nature of discourse communities and writing in the disciplines have emerged as significant elements of composition instruction at the close of the twentieth century, the two teaching philosophies that defined writing instruction at the close of the nineteenth century continue to influence contemporary writing instruction. And while Current-Traditionalism and Expressionism remain a part of present day writing

instruction, it is the Current-Traditional method that is the most conspicuous when one thinks of writing instruction in the scientific and technical disciplines.

The first textbook geared toward the Current-Traditional method of writing instruction, Alexander Bain's *English Composition and Rhetoric*, was published in 1866 and clearly exhibits the strong instructional emphasis on style and form (Winterowd 30). With instruction focused on learning the rules of grammar and correct mechanics, the written product, not the process involved in constructing the text, holds the main concern for both teacher and student.

Cited by Ross Winterowd as "the archetype for current-traditional pedagogy" A. S. Hill's *The Foundations of Rhetoric*, published in 1897, clearly illustrates this concern for style and form:

Differ as good writers may in other respects, they are all distinguished by the judicious choice and the skillful placing of words. They all aim (1) to use no word that is not established as part of the language in the sense in which they use it, and no word that does not say what they wish it to say so clearly as to be understood at once, and either so strongly as to command attention or so agreeably as to win attention; (2) to put every word in the place fixed for it by the idiom of the language, and by the principles which govern communication between man and man--the place which gives the word its exact value in itself and in its relations with other words; and (3) to use no more words than are necessary to effect the purpose at hand. If it be true that these principles underlie all good writing, they may properly be called The Foundations of Rhetoric. (Winterowd 32)

Hill admits that writers may differ somewhat, but what every good writer has is the ability to make judicious choices with regard to word use and placement. More specifically, he identifies three principles that constitute correct writing, all of which correspond to surface level and stylistic features of a text. Good writing is defined by the writer's ability to use the proper word, place it in the proper position, and use only the necessary number of words. For Hill and others who followed the Current-Traditional method of instruction, good writing is nothing more than gaining the skills of how to properly use and place words in order to gain optimum clarity and attention. Nowhere in Hill's instruction is there any concern for the relationship between form and content or the writing process itself. With this in mind, it is hard to discredit Winterowd's claim that form and style are the "whole" of Current-Traditional rhetoric (32).

The emphasis that Hill and other Current-Traditionalists placed on style was heavily influenced by a number of philosophic beliefs that were prevalent at the time. In his discussion of the various pedagogical theories existing in composition, James Berlin claims that the rise of Current-Traditional rhetoric was tied to the emergence of Common Sense Realism (237). Founded in the belief of an observable reality, Common Sense Realism proposes that an individual can discover truth through the relationship between the senses and the mind. Observation, experimentation, and the rational mental processes involved in interpretation become the key terms in this new way of viewing the world. The scientific method and the intellectual capacity to formulate ideas through the process of association--expressed by philosophers such as John Locke and Descartes--provided the philosophical foundation by which Common Sense Realists constructed their versions of reality.

Therefore language occupied a somewhat less than substantive role in the truth-making endeavor. Since truth was observable and interpretable through a rational and experimental process, the position that language and rhetoric held as part of the means to

truth was subsequently diminished. No longer were the classical methods of the syllogism or the process of rhetorical invention necessary to discover truth. The truth or the content of any communication resulted from one's own observations and interpretations and was no longer generated through any formulaic method of topoi or commonplaces. Rhetoric and language -- since no longer viewed as part of the discovery process -- were subsequently relegated to the simple task of merely transmitting what had already been observed and interpreted.

The split between invention and reality and content and form is evident not only in the Common Sense Realism movement, but it is also a significant feature of the earlier writings and philosophy of Peter Ramus. As with the Common Sense Realists, Ramus also believed in the rational capacity of the human mind. In their analysis of the sixteenth century rhetorician, Patricia Bizzell and Bruce Herzberg note that Ramus believed that humankind was granted the "two universal, general gifts of Reason and Speech" (561). For Ramus, the rational mental faculties provide the means for humankind to invent and arrange. Accordingly, the rhetorical canons ascribed to these functions -- invention and arrangement -- have more to do with the gift of reason than the act of speech. Speech and rhetoric thus become more closely associated with the rhetorical canons of style and delivery. This split between content and form continued through the Enlightenment and eventually fed the Current-Traditionalist view that the teaching of writing should resign itself to nothing more than concern for ornamentation and style.

The Common Sense Realists and the Current-Traditionalists were also aware of the inherent capacity of language to obfuscate the communication of the observed reality. John Locke's view of language is particularly important with respect to this point. He writes that "It is easy to perceive what imperfection there is in language, and how the very nature of words makes it almost unavoidable for many of them to be doubtful and uncertain in their significations" (699). This inherent imperfection in language is why Current-Traditionalists such as A.S. Hill placed such importance on the skills of proper use, placement, and number. Correct writing involves the selection of the most perfect word and placing it in the most proper place thus removing any potential that the imperfection and multiple significations inherent in language could lead to any misinterpretation.

From the Current-Traditionalist perspective, the act of selection remains a part of the rhetorical process, but the choice does not involve decisions regarding the topoi or commonplaces needed to invent or organize the content. Instead, selection corresponds solely to the choice of words that can -- without any potential for ambiguity or confusion -- best represent the content. Since the discovery of truth occurs outside the rhetorical process, the aim of language is to communicate this discovery in such a manner that any possibility of misinterpretation or ambiguity is minimized. In *An Essay on Human Understanding*, John Locke speaks directly to this issue:

"We should cast off all the artifice and fallacy of words, which makes so great a part of the business and skill of the disputers of this world; pretending to the knowledge of things, we hinder as much as we can the discovery of truth, by perplexing one another all we can by a perverse use of those signs which we make use of to convey truth to one another" (698)

Locke's concern over the imperfection of language is unquestionably evident here. Not only does he consider language deficient in terms of precise significations, Locke also

perceives language as nothing more than a fallacy and an artifice. Because of its ability to perplex, Locke voices concern for those who use language and rhetoric in such a way as to "hinder the discovery of truth" and claims that such users of language are simply the "pretenders of knowledge." To accurately represent and communicate truth, one must do so in a language that corresponds directly to the objects in the external world. And as listeners and readers, we also must be cognizant of the deceitfulness of those who seek to use the artifice of language. As Berlin's explanation of Common Sense Realism points out, "when the individual is freed from the biases of language, the senses provide the mental faculties with a clear and distinct image of the world" (238).

The pedagogical philosophy of Current-Traditionalism and the philosophies that have contributed to the emphasis on form have direct relation to the attitudes of writing in the scientific and technical disciplines. In many technical writing textbooks, the message reiterated over and over again is that any communication should be clear, concise, and objective. In Jerome Borowick's *Technical Communication and its Applications*, the first chapter defines technical writing as such:

Effective technical writing is objective, clear, concise, and convincing. This is accomplished when the style is descriptive and quantitative; that is, when the writing includes details and uses facts, data, measurements, and statistics. All pertinent information is presented in a manner that can be objectively evaluated and concluded by the reader. Imprecise, judgmental, emotional, and editorial words such as many, undue, or annoying are avoided to deter readers from interpreting the magnitude of the meanings of these words based on their own personal experiences. Only information pertinent to the purposes of the report is included. Information that is interesting, but not pertinent, is excluded. (4)

From the opening comments in this textbook, the prospective technical writer comes across the Current-Traditional refrain that writing must be objective, concise, and clear. And perhaps even more interesting is Borowick's claim of a discernible distinction between the objective language of facts and data and the language of multiple significations found in judgmental and emotional words. The objective and positivistic regard for the validity of facts over the imperfection of subjective judgments is clear from Borowick's statements and so is the suggestion -- as touched on earlier in the discussion of Locke and the Common Sense Realists -- that language, because of its apparent impreciseness, can indeed confuse and lead to possible misinterpretation. In order to prevent such an occurrence in their communication, Borowick suggests that technical writers focus exclusively on the facts since the language of data, measurements, and statistics is seemingly free from distortion and ambiguity. In much the same vein as Current-Traditionalism, the process of technical writing, in Borowick's view, becomes associated with the unambiguous transmission of the facts, data, and observations recorded outside the rhetorical act. Rhetoric and language as a whole subsequently have no part whatsoever in any interpretation of the objective reality.

In another technical writing textbook written by David Beer and David McMurrey, *A Guide to Writing as an Engineer*, the second chapter is devoted to what the authors refer to as "Some Guidelines for Good Engineering Writing." As with the Borowick book, the theme for Beer and McMurrey is also preciseness and clarity -- style issues -- as they separate the chapter into sections dealing with such skills as "getting to the point," "vagueness," "ambiguity," "clearness," and "redundancy." The emphasis on garnering the skills of usage echoes the traits that Current-Traditionalist A.S. Hill stressed

as the keys to correct writing. Even with the focus on basic surface level skills, the textbooks by Beer, McMurrey, and Borowick do acknowledge other features important to the writing process such as audience and purpose. Additionally, judicious word choice and the attainment of a lucid communication are valid and worthwhile elements of good writing. However, the significance of having the opening chapters focused on discussions of clarity and style should not be overlooked. As illustrated by the dates of publication for these two textbooks -- 1996 and 1997, respectively -- the emphasis on style as a separate component from the content of the communication remains to this day technical writing's central defining feature.

The concern for clarity and objectivity evident in technical writing textbooks should come as no surprise since the technical community itself recognizes the role that these basic skills have when it comes to communication. In the following passage from the *1973 IEEE Transactions on Professional Communications*, a publication produced by the professional association of electrical engineers, the skepticism toward language and rhetoric exhibited in the technical writing textbooks is unmistakably stated:

Rhetoric is designed to persuade or impress; the word may be considered a euphemism for loaded language.... Anyone who is convinced that only facts should persuade must, logically, condemn such rhetoric in the scientific literature. Realistically, of course, rhetoric cannot be eliminated entirely. But its use can be constricted significantly, and both readers and writers should be on guard against this violation of scientific principle.... Since scientists agree that their observations and conclusions should be presented as objectively as possible, rhetoric should be avoided assiduously in scientific writing. (Miller 140)

The call for objectivity heard in the textbook by Borowick rings loud and clear in these comments. For the members of the IEEE, a clear separation also exists between the foundational truth that can be communicated through the presentation of facts, data, and observations and the editorial language of judgment. A technical document must be written in such a way as to be objectively evaluated, a task seemingly made impossible through the use of the "loaded language" of rhetoric. Any use of rhetoric produces a non-objective communication, which is a clear "violation of scientific principles."

The argument that rhetoric is associated with persuasive powers that can potentially produce some type of negative consequence was expressed long before the IEEE and John Locke. It was Plato, who in the *Gorgias*, indicated that rhetoric is nothing more than a system that can be used in any situation for unethical ends:

I insist that it is not an art but a routine, because it can produce no principle in virtue of which it offers what it does, nor explain the nature thereof, and consequently is unable to point to the cause of each thing it offers. And I refuse the name of art to anything irrational. (73)

Locke questioned the value of rhetoric based on its potential to create a fallacious construct of knowledge and thus considered it to be merely an artifice. Similarly, Plato claims that rhetoric is simply a routine that does nothing but feign reality. In a frequently cited passage from the *Gorgias*, Plato argues that rhetoric is "as a whole, not an art, but the occupation of a shrewd and enterprising spirit, and of one naturally skilled in its dealings with men: and in sum and substance I call it 'flattery'" (72). Similar to Locke and the members of the IEEE, Plato is concerned about rhetoric's potential to

misrepresent, which leads not only to the distortion of the facts but can also lead to something quite unethical. "It [rhetoric] has no need to know the truth about things but merely to discover a technique of persuasion, so as to appear among the ignorant to have more knowledge than the expert" (Plato 69). Plato, Locke, and the IEEE clearly represent the age-old debate over the relationship between form and content and rhetoric's position within the communicative act--because of its perceived distinction from truth and knowledge--as a source of potential dissonance. With this view of rhetoric, one can see why the science and technical communities would wish to avoid its use so "assiduously."

In her study of engineers and how they view writing within their profession, Dorothy Winsor found comparable attitudes concerning the separation of content and form and the distinction between an observable reality and rhetoric. "Engineers view themselves as creating objects," Winsor discovered. The act of writing (for an engineer) is merely to transmit knowledge; writing does not generate it (58). For the technical community, writing and communication is an after-the-fact process. Writing may not even be considered a process in itself since it is incidental to the interpretation and the generation of knowledge that have already taken place in the objective environment of the laboratory. Writing is simply the act of simulating through words the observable and objective reality of nature, an approach well suited to the Current Traditional method of composition. With reality and truth already identified through the observation of facts and data, the writing process becomes one of merely transferring this objective reality -- truth, knowledge, or however it may be classified -- onto the paper and thus to the reader. Invention is not necessary or even considered since the truth and the resulting information that will be transmitted have already been constructed and discovered. What is needed to promote good writing is instruction on how to communicate this information in the most concise, accurate, and quickest means possible and without the loaded language of rhetoric or the multiplicity of meanings possibly interfering with the presentation of the facts.

It is important to stress at this point that these characterizations of technical writing should not be blindly dismissed nor should the idea that proper word use, placement, and concerns for clarity and conciseness cannot play a substantive role in any technical writing instruction. Along similar lines, the discussion of the Borowick and Beer and McMurrey textbooks should not be solely interpreted as a criticism of their functionality. The notion that technical information should be communicated in a clear and concise manner is a fundamental principle of technical communication and is inherently tied to its function and the nature of its interpretation. With the frequent use of complex and compound word constructions often found in technical communication, it is important that any information that is nonessential or that could possibly serve to complicate the task of interpretation be eliminated.

There are, in fact, various strategies that can be taught in order to make the technical document easier to read. Peshe Kuriloff, in her study of engineering discourse, mentions certain skills with regard to syntax that should be stressed, all of which speak fundamentally to the concept of clarity and to easing the burden of interpretation. She mentions that in technical writing "the subject and verb should be kept close together, the point of the sentence should be placed at the stress position, and that relevant information should be placed in the topic position" (495). And while these skills may be useful in order to produce a very readable technical text, they closely resemble the emphasis on use and placement that was found in what Winterowd called the archetype of current-traditional practice -- Hill's *The Foundations of Rhetoric*. Good writers, as Hill claimed

in 1880, have the ability to skillfully position each word in "the place which gives the word its exact value in itself and in its relations with other words."

All of these characteristics of technical writing -- the objectivity, the emphasis on form, and the disregard for rhetoric in exchange for the value-free language of fact -- are expressed by Charles Bazerman, who has done a considerable amount of research in writing in the science and technical fields:

A scientist must remove himself from reports of his own work and thus avoid all use of the first person. Scientific writing should be objective and precise with math as its model. Scientific writing should shun metaphor and other flights of rhetorical fancy to seek a univocal relationship between work and the object. A scientific article should support its claims with empirical evidence from nature, preferably experimental. (Hunston 66)

Even with Bazerman's apparent tone of exaggeration, the premise that scientific writing should be impersonal, objective, and free from any of the dangerous tendencies related to the loaded language of rhetoric remains clear. Additionally, many students identify technical writing as having these same properties. When questioned about their perceptions of technical writing, sophomore engineering students at the University of South Carolina voiced many of the same opinions regarding matters of clarity and conciseness. These students -- many of whom had little or no experience with scientific and technical writing -- talked about the "bare bones" approach to technical writing and the ability to "document things in the quickest and easiest way possible." One student even described technical writing as being "where the writer makes his point as quick as possible and then goes away." It is clear from these comments that prior to any experience or instruction in technical communication, students bring with them an embedded image of what and how they will be asked to write.

But when compared to the type of writing that these students have done in the past, the writing task they face when asked to produce a technical document appears to be strikingly dissimilar. Prior to their first attempt at any technical writing, a significant pedagogical model that students encounter in their freshman English classes and even within their high school writing experience is one that encourages the use and development of the student's personal voice. The following comments expressed by students at USC indicate the goals and direction of their previous composition instruction. Recounting their high school and college writing experience, students often referred to the "creative" nature of their past writing, and many spoke of their writing experience in terms of how many of their assignments were geared toward the "expression of one's thoughts and ideas." Another student commented that "It is important while writing that one express their feelings or findings in a way that reflects them. A writing style can identify a person as easily as a figure [sic] print." Considering the Expressionistic emphasis on the personal quality of writing, an inherent conflict appears to be inevitable when students enter their technical fields since they have encountered a pedagogical theory that seems to run counter to the communication needs of the technical community.

Given this context, it is somewhat ironic that the Expressionist method of instruction that guided many of these students' writing experiences is considered by many to have evolved as a response to the Current-Traditionalist concern for form and style. Ross Winterowd argues that, "In the 1960's and 1970's the Romantic tradition first manifested itself in composition largely as a reaction against Current-Traditionalism"

(39). While the Romantic tradition may be best known in terms of its importance in literature, its influence on writing instruction is also of extreme significance. As stated earlier, composition instruction at the turn of the nineteenth century was split along two methods, one of which had direct ties to the beliefs of the Romantics. For the Romantics, formulas, whether pertaining to intentional techniques or prescribed classifications of style, were replaced by the power of the individual imagination. Since individual experience and not a rhetorical technique was responsible for discovering subject matter, determining what should be said or written was not something that could be readily prescribed. Each experience is unique, and the form of expressing it is just as idiosyncratic. Beyond emphasizing the individual, the Romantics represented a rejoining of content and form since both were seen as symbolizing the unique creativity of the individual.

Although William Wordsworth's beliefs are directed toward the art of poetry, his contributions and influence on the Romantic and Expressionist movement in composition also need to be recognized. In his often-cited *Preface to Lyrical Ballads*, Wordsworth outlines the basic principles guiding the Romantic Movement where the interest lies in the language and life of the common man rather than the prescriptive subject matter and language that had previously been assigned to poetry.

The principle object, then, which I proposed to myself in these poems was to choose incidents and situations from common life, and to relate or describe them, throughout, as far as was possible, in a selection of language really used by men. (143)

The goal of the Romantics was to overthrow the classical notions of poetic decorum that had dominated the period before them with poets such as Alexander Pope and John Dryden:

Such a language arising out of repeated experience and regular feelings is a more permanent, and a more philosophical language, than that which is frequently substituted for it by poets, who think that they are conferring honor upon themselves and their art, in proportion as they separate themselves from the sympathies of men, and indulge in arbitrary and capricious habits of expression, in order to furnish food for fickle tastes, and fickle appetites, of their own creation. (Wordsworth 143)

The Romantic creed that individual expression should transcend any concern for prescribed form and that all language should be given equal value have, in fact, become defining features of the contemporary composition classroom.

In terms of the Romantic influence on composition instruction, Winterowd defines four elements behind the new pedagogy: self-expression is exalted; imagination (genius, creativity) replaces invention; craft is devalued; public discourse is devalued (37). Craft -- the formalized set of rules that guide Current-Traditional instruction -- is sacrificed for the sake of personal expression. Any attempt to convey the authentic and unique quality of personal experience could not occur through a prescribed and universal form or craft. The call for this authenticity can be heard in the familiar mantras of Peter Elbow and Ken Macrorie, two of the leading scholars in the Expressionist and Romantic Movement. Macrorie and Elbow both cite the need to provide student writers the opportunities to find their "true and authentic voice" (Winterowd 43). The true voice is that which comes from the writer's personal view of reality, and the way to accurately communicate this personal reality is through one's own mode of communication. As

James Berlin states, this "fresh, personal vision" -- brought to the forefront by the Romantics -- "demands an original use of language" (241). The words used by Berlin -- *fresh, personal*, and *original* -- clearly indicate a contrast in the goals of the Expressionist movement with those of the Current-Traditionalists.

With the self becoming the defining feature of the Romantic movement, whether in the act of communication or the search for truth, a question arises as to the applicability of such a pedagogy within the technical community where the distancing of the self is a fundamental feature not only in its communicative theory but also in its search for empirical truth. The expression of one's self must remain secondary to the communication, or as the statement from the IEEE indicates, a violation of the objective principles of scientific observation may occur. Based on the beliefs of such Expressionists as Elbow and Macrorie, it would seem that Expressionism -- and the desire for individual freshness and voice -- has no place in a technical writing environment.

However, when placed within the context of genres and discourse conventions, the issue of an individual writer's position in relation to technical writing begins to emerge. The topic of genres and discourse communities provides a space where theories of New Rhetoric and Expressionism can be integrated into any discussion of technical writing. Since New Rhetoric proposes that communication involves cooperation, community, and in Kenneth Burke's words, identification, the writer -- when compared to the position granted by Current-Traditionalism and Expressionism -- occupies what can be considered as a third position. Current-Traditionalism aims to distance the individual writer for the sake of attaining the uniformly accepted measures of style and form. In direct contrast, Expressionists sought to elevate the self beyond conformity of universal decorum to the point that individual expression of thought and form came to be considered the true value of proper writing. As if engaged in dialectic with these two pedagogies, New Rhetoric situates the individual in an act of negotiation. Writing involves the individual's ability to mediate his own beliefs and stylistic conventions with those of the discourse community he wishes to enter. "Students must learn to 'talk' the other person's language, identifying insofar as possible with the reader's values, goals, and aspirations" (Winterowd 78).

Central to this philosophy of negotiation is the postmodern belief in the multiplicity of the subject. In contrast to the autonomous self and the universality that characterized the empiricists, postmodernism stresses the idea of fragmentation not only in terms of knowledge but also with respect to the possibility of a stable subject:

Postmodern theory decisively rejects the primacy of consciousness and instead has consciousness originating in language, thus arguing that the subject is an effect rather than a cause of discourse. Because the subject is the locus of overlapping and competing discourse, it is a temporary stitching together of a series of often-contradictory subject positions. In other words, what a person does, thinks, says, and writes cannot be interpreted unambiguously because any human action does not rise out of a unified consciousness but rather from a momentary identity that is always multiple and in some sense incoherent. (Faigley 9)

Successful communication in the postmodern sense depends upon the writer's ability to occupy the proper subject position where the individual identifies with the prescribed values and judgments of the community in which he is taking part even if this involves identifying with contradictory belief systems. This notion of subjectivity has been a

frequent topic in conversations concerning basic writers and academic discourse and is illustrated in David Bartholomae's lucid description of the task facing students entering the university for the first time:

Every time a student sits down to write for us, he has to invent the university for the occasion--invent the university, that is, or a branch of it, like history or anthropology or economics or English. The student has to learn to speak our language, to speak as we do, to try on the particular ways of knowing, selecting, evaluating, reporting, concluding, and arguing that define the discourse of our community. (589)

The goal of attaining a fresh and original voice -- as the Expressionists championed -- is no longer possible in the postmodern environment. Students entering the university have to speak and write "our language" and "speak as we do" according to Bartholomae. Once again, the individual writer seems faced with conformity to a prescribed mode of communication. Yet if the writer is indeed involved in a process of negotiation, then the task of writing within a community becomes not one of conformity but of self-fashioning as in noted critic Stephen Greenblatt's use of the term. *In Renaissance Self-Fashioning: From More to Shakespeare*, Greenblatt states that the act of self-fashioning "requires both an enabling institution, a source of power and communal values, and a perception of the not-self, of all that lies outside, or resists, or threatens identity" (175). With respect to students entering the technical writing discourse community, the writer must move beyond mimicking the talk of the community to consciously -- and this is the key word -- fashioning a self or a voice that conforms to the community's beliefs and values. It is the conscious ability of the student to recognize the negotiation she is involved in -- or as Greenblatt states, the perception of the "not-self" -- that separates what can be considered slavish imitation of the community's discourse and an individual's communicative power to shape her own position within the community. The question then becomes one of how much authority the discourse community has over the writer and vice versa.

Bartholomae also writes that when students enter a university they are faced with learning to communicate within the conventions of academic discourse and within specific academic disciplines as well. When writing for a history class, a student is expected to follow the academic conventions of the academy as well as the conventions of the discipline of history. The same can be said to apply for students in any field of study. Each of these disciplines, or enabling institutions, as Greenblatt would refer to them, is defined not only by specialized subject matter but also through specialized modes of communication. This notion of discourse communities is perhaps best defined by John Swales:

It is commonplace within the composition field that disciplines are constructed in part by the discourse that is used within that select group. The group develops expectations for how productive exchanges of information should proceed, which is to say that the group shares discourse conventions or "genres." The group's discourse is thus specialized, but exhibits a tendency to become increasingly specialized. There is a built dynamic towards an increasingly shared and specialized terminology. There must be a "critical mass" of experts in the group at any given time, people who are intimately familiar with the specialized genres with which the group seeks to accomplish its goals. (Bizzell 226)

Discourse communities are constructed not only by particular ways of knowing and arguing but also by a specialized vocabulary. In direct contrast to the radical

individualism of Expressionism, New Rhetoric's construct of discourse communities indicates the exclusionary potential of language. If one cannot communicate as a member of the group -- cannot speak, think, or argue as other members do -- then one cannot participate. Thus, the need for successful negotiation between complete conformity to the discipline's conventions and any potential personal authenticity of the individual writer becomes ever more vital.

In the postmodern sense, the issue of conformity seems somewhat contradictory since no individual or authentic subject position exists. Yet in terms of writing instruction--specifically pertaining to instruction within a specialized discipline--the issue of conformity versus individuality is of extreme importance. Even if the postmodern position of subjectivities is granted, fundamental issues such as how the student can position himself as one of the "critical mass of experts" and thus appropriately communicate within the community must be considered. If the student is unaware of the discourse conventions, then how is this student supposed to approximate them or know that his attempts at individual expression are violating the principles?

In the contemporary composition classroom, the issue of conformity pertaining to students' approximations of academic discourse has given rise to discussions of student empowerment specifically in relation to the underrepresented populations that have come to make up an increasing number of college enrollments. Teaching the literacy skills needed to master the conventions of academic discourse provides the means by which these students can participate within the academic community. Yet with the need to learn these conventions as a means to participate, some composition scholars are concerned that in the process students lose their fresh, personal voice along with the prevailing beliefs and history that are vital components of their home communities. While becoming socialized within the academic discourse community or even the technical discourse community, students risk losing the communicative authority that has allowed them access to and participation within other discourse communities.

It may seem that the idea of the postmodern self may be far removed from students entering technical disciplines and specifically the engineering discourse community, but the concern over conformity and empowerment is an important issue to consider when teaching these students how to write. When facing the concern over what may be lost with respect to individuality in the process of acquiring the skills of engineering discourse, writing instructors must provide a means for students to become more than passive conformists to disciplinary conventions. Students should be given the potential to become proactive members of the community -- and membership within the critical mass of experts -- when it comes to writing and communication.

The potential to direct writing instruction into a strict concern for genre can be an easy trap when one considers the prescriptive nature of such genres as the lab report. As mentioned, a depersonalized tone, emphasis on the facts and data rather than on personal innuendo or anecdote, and the concern for overall clarity and conciseness are three defining features of technical communication. By looking at the specifics of the genre of the scientific laboratory report, additional conventions are added to the mix. In her analysis of the lab report, Elaine Maimon has identified seven sections that are repeatedly found:

1. Title
2. Abstract
3. Introduction
4. Methods and Materials

5. Results
6. Conclusions
7. References Cited

Maimon characterizes each of these sections by the information it contains as well as the mode of discourse used. For example, Maimon states that the "introduction is a short expository essay that presents an overview of relevant research. The results section includes description, narration, and exposition, with the verbal material almost always supplemented by graphic representations: tables and graphs" (114). So along with the need for an impersonal tone and the emphasis on conciseness and clarity, a writer must follow the conventions assigned to each of these sections in order to write what would be considered a correct lab report. Stepping outside any of these conventions could easily result in misinformation or even the discrediting of the writer. As Maimon says, genres are more than just static conventions and are constructed in part by the "relationship between reader and writer" (111). When a reader reviews a lab report, specific expectations exist with respect to where certain information will be contained and how it will be presented. Not having relevant research in the introduction -- a violation of the prescribed conventions of the lab report -- may diminish the communication and subsequently affect the credibility granted to the writer.

In addition to identifying with the reader's expectations, the student writer -- when entering a new discourse community -- is also engaged in a negotiation with his previous language conventions. Bartholomae writes, "The movement toward a more specialized discourse begins (or, perhaps, best begins) both when a student can define a position of privilege, a position that sets him against a 'common' discourse, and when he or she can work self-consciously, critically, against not only the "common" code but his or her own" (610). Here again, the process of self-fashioning becomes apparent. The student engages in a negotiation where the conventions from previous discourse communities come into contact with the conventions of the specialized discourse. Yet even more important is Bartholomae's claim that the student must "self-consciously" be made aware of the conflict between these discourse communities. The student is indeed cast in the role of Greenblatt's self-fashioner as he finds himself caught between the communal powers and values on one side and the self-conscious recognition of threats to his own position and identity. This self-conscious awareness corresponds to the writer's ability to fashion a position of privilege and expertise within the community. With respect to lab reports, instruction can indeed be tailored to allow students to master the "common" conventions of the genre. Yet the learning process seems shortchanged if students merely settle for repeating and imitating the "common" code and are not allowed to define their own position within the discourse.

Of particular relevance to this self-conscious act of authority is New Rhetoric's concern for the relationship between content and form whereby language reassumes a role in the construction of knowledge. Whereas Ramus had viewed reason and speech as separate entities, New Rhetoric reaffirms the belief that speech and language have a defining role to play in the construction of knowledge, a role directly corresponding to the faculty of reason. As Ann Berthoff explains:

Meanings are relationships. Seeing means "seeing relationships," whether we're talking about seeing as perception or seeing as understanding. "I see what you mean" means "I understand how you put that together so that it makes sense." The way we make sense of the world is to see something *with respect to, in terms of, in relation to* something else.

We can't make sense of one thing by itself; it must be seen as being like another thing; or *next to, across from, coming after* another thing; or as a repetition of another thing. *Something* makes sense -- is meaningful -- only if it is taken with *something else*. (Berlin 244)

While Locke may have viewed language as an imperfect system of signification, his theory of how the rational thought process works through associations is fundamental to New Rhetoric. Both Locke and Berthoff assert that meaning or knowledge is created by the ability to distinguish relationships and associations. Just as the mind works via a process of associations in order to produce an idea, so does the process of writing:

Words and word combinations, sentences and strings of sentences forge the connections that mental activity strives to intuit: they provide structures by which orderly, connected thinking can occur. Making verbal statements, therefore, is equivalent to carrying out intellectual investigation -- or generalizing linguistically to comprehend experience. It is a heuristic process whereby the effort to assert connections and array them as integrated verbal patterns -- texts -- yields new understanding: in effect, new knowledge. Discourse, then, far from having the restrictive presentational function that the ancient rhetoricians supposed, actually has a central, generative role in the pursuit of knowledge. (Knoblach and Brannon 53)

For Knoblach and Brannon, the emphasis is also on striving to form connections. The coherence of a text -- the ability to make sense of it -- occurs when the verbal structures simulate "orderly, connected thinking." Perhaps of most significance to this assumption is the generative quality inherent to discourse. Writing becomes much more than finding the right word, placing it in the right position, or following the conventions of a specified genre. Composing, as Knoblach and Brannon propose, is now "equivalent to carrying out intellectual investigation."

Yet how does this claim fit within technical communication where language is seen as a separate act from the production of knowledge? The answer to this question centers on the distinction between writing knowledge and subject knowledge. An argument can be made that a technical or scientific experiment is indeed an intellectual investigation or a process designed to validate, create, or dispute knowledge. In fact in any discipline, intellectual investigation is constantly being performed in an effort to add new knowledge. This knowledge, referred to as "knowledge statements" by Bazerman, is transmitted through a text and the relationship between the reader and writer (108). Even within the scientific and technical community, creating a statement of knowledge requires more than just the simple task of creating the appropriate table or graph. In *Is Teaching Still Possible? Writing, Meaning, and Higher Order Reasoning*, Ann Berthoff writes the following:

Empiricists do not generally recognize that all method, including scientific method, entails interpretation; they do not generally recognize that there are no raw data; there are no self-sufficient facts; there is no context-free evaluation. Their method is not to recognize the fact that all knowledge is mediated and that facts must be formulated, but to proceed as if interpretation were supererogatory. (309).

Any representation of facts or data entails communication. Yet forming this communication -- via the pattern of association and relationships -- is inherently unique

to each individual. The Expressionist concern for the uniqueness of the individual with respect to comprehending experience emerges again. Technical writing thus becomes a task of negotiating individual thought and expression with the conventions and prescriptions of the genre and community.

In terms of technical writing, one seems left with a dilemma with respect to the empiricist perception of the generative quality of facts and data and the static state of language. Yet as the theories of New Rhetoric propose, language plays a significant role in the interpretation of facts and data and the resulting creation of knowledge. Language is not as removed from the experimental activity that the technical community seems to believe. Furthermore, if the context becomes one of student writing and the process of learning, it is essential that the instruction consider the congruity between learning, the creation of knowledge, and writing.

It may indeed be the case that within these pages some aspect or principle regarding compositional and rhetorical theory has been omitted, yet the relationship between the theories discussed to technical writing has been established. The technical community clearly places a certain value on specific discourse conventions, and instruction should accommodate these practices in order to prepare students to successfully participate. However, to restrict instruction to these conventions and to funnel student writing so that it merely fills the forms of these conventions limits the generative capacity not only in terms of student writing but also restrains their creative ability as intellectual investigators. If writing is akin to thought, then each student's ability to make sense out of an experience, experiment, or observation must be recognized as well as each student's ability to produce knowledge statements that convey her unique observations and interpretations. The goal is to create competent communicators who not only can write within the prescribed conventions of the discourse community but who are also subsequently equipped with the conscious ability to successfully use language as an integral function of their intellectual investigation.

CHAPTER II

An Analysis of Student Texts: Exercising Choice and Authority Within the Confines of a Discourse Community

In 1978, linguist M.A.K. Halliday published the book *Language as Social Semiotic*. Though he is better known for his earlier work *Cohesion in English*, Halliday's 1978 text was instrumental -- particularly in linguistics -- in bringing to light the connection between the social environment and the way language is used. Halliday writes "We shall not come to understand the nature of language if we pursue only the kinds of questions about language that are formulated by linguists. For linguists, language is object" (3). This proclamation helped to bolster the sociolinguistic movement and to solidify within language studies the impact that the social environment has on language production. Since discourse was no longer viewed as a simple object of surface features, any complete understanding of language had to take into account the social interactions that influenced the production of these syntactic and morphological forms.

In *Language as Social Semiotic*, Halliday discusses the relationship between language use and the social environment through a term he defines as register:

The registers a person has access to are a function of his place in the social structure. Language *actively symbolizes* the social system, representing metaphorically in its patterns of variation, the variation that characterizes human cultures. This is what enables people to play with variation in language, using it to create meanings of a social kind: to participate in all forms of verbal contest and verbal display, and in the elaborate rhetoric of ordinary daily conversation. It is this same twofold function of the linguistic system, its function both as expression of and as metaphor for social processes, that lies behind the dynamics of the interrelation of language and social context; which ensures that, in the micro-encounters of everyday life where meanings are exchanged, language not only serves to facilitate and support other modes of social action that constitute its environment, but also actively creates an environment of its own, so making possible all the imaginative modes of meaning, from backyard gossip to narrative fiction and epic poetry. (3)

Primary to Halliday's concept of register is the belief in the wide variation inherent in language. Even those more inclined to view language in terms of form and object acknowledge the unlimited variation and creative capacity of language that allows a speaker or writer to craft a sentence or phrase that has never been previously spoken or written. Yet with this much creativity, play, and variation in language, some regulatory system must exist that governs the appropriate structures of communication. The governing system, for Halliday and other sociolinguists, is in fact the social environment where the communication takes place. Whether it be friendly gossip or classroom discussions of fiction or poetry, certain conventions particular to each of these environments dictate the mode of communication.

This is, admittedly, a highly abridged description of Halliday's notion of register, but it serves as an introduction to the specific topics that will be raised in this chapter. If writing teachers are concerned with the entire writing process, then an understanding of the social context in which the writing takes place must be of concern, and those who

have been instrumental in bringing the theories of discourse communities to light have played an important role in moving composition instruction in this direction. As stated in the previous chapter, distinct discourse conventions particular to the technical community as well as the genre of the lab report dictate the appropriate language and suitable means of address. So in attempting to formulate a definition of writing knowledge within a specific discipline, some type of description of the social environment in which the writing takes place must be performed.

Halliday also argues that language *actively symbolizes* the social system. In other words, the particular conventions of the discourse community not only shape the language use, but the language, in turn, actively represents these same conventions. This is evident by a quick examination of the technical community's reliance on facts and data rather than personal judgment as its regulated means of communication, a feature well represented in the community's language use. Anyone writing within the technical community is subject to these particular conventions, just as anyone reading within the discipline expects the discourse to actively symbolize these same principles. So in effect, as Halliday claims, the discourse "expresses" and also serves as a "metaphor for the social context."

Since the objective of the previous chapter was to situate various pedagogical and rhetorical theories into a description of technical writing, the subsequent logical step is to move the theoretical discussion into a more practical realm. And since, according to Halliday, the discourse itself represents and serves as a metaphor for the social system, the discourse -- or in this case, student texts -- can shed some light not only on the social context in which students are writing but also on the descriptions from the previous chapter that have been postulated concerning technical writing. A theoretical understanding of technical writing has been developed which has taken into account the various discourse conventions of the technical community as well as the relationship between these conventions and the individual writer. Adding an analysis of student texts with respect to the major points discussed so far can only provide a more comprehensive understanding of the wide spectrum that is engineering writing.

With the analysis designed to consider the issues raised earlier, this study will turn again to Halliday in order to provide a guiding taxonomy whereby the social environment and the discourse itself can be taken into account. In describing any social environment, Halliday refers to the three categories of field, tenor, and mode:

Field refers to the institutional setting in which a piece of language occurs, and embraces not only the subject matter in hand but the whole activity of the speaker or participant in a setting (we might add: and of the other participants)....

Tenor...refers to the relationship between participants...and not merely variation in formality...but such questions as the permanence or otherwise of the relationship and the degree of emotional charge in it....

Mode refers to the channel of communication adopted: not only the choice between spoken and written medium, but much more detailed choices (we might add: and other choices relating to the role of language in the situation)....(33)

When attempting to comprehend Halliday's concept of field, one might consider the metaphor of the sporting field or arena. Within the baseball diamond, tennis court, or football field, a particular action occurs with specific rules and specialized subject matter and vocabulary attached to this event. Regardless of the social situation, rules and subject matter particular to that place and time exist whether the scene is a history

classroom, a car dealership, or any other social scene. Along with the social setting, the relationships among the participants must also be considered. For example, in the setting of the car dealership, the buyer and seller are assigned specific roles as are the teacher and student in a history class. And in every social situation where communication takes place, a particular genre prevails whether it be the verbal sell, the classroom lecture, or even the scientific lab report.

For this study, Halliday's classification of the social environment allows the specific engineering environment to be faithfully described. So rather than provide a broad and possibly scattered description of the social space, the three categories of field, tenor, and mode allow for a more systematic definition. The field in which the writing for this study takes place is a sophomore engineering class at the University of South Carolina. More specifically, the class -- EECE 201 -- is designed for electrical and computer engineering majors, so the context of the discussions and the resulting subject matter and vocabulary will deal with this particular field of study. For further clarification, it is also important to describe the writing environment and the basis for the writing assignments. The course is a combination of a two-hour recitation period and a three-hour laboratory session with the writing generated primarily from the lab exercise, which is structured so that students can apply certain electrical engineering theories that have been discussed in the two-hour recitation. Because of the integration of the lecture and lab segments of the course, a strong emphasis is placed upon the students' ability to make connections between various electrical and circuit theories and their practical applications. The writing thus serves in part to provide students the opportunity to explain their observations in the laboratory with respect to the practical use of the various theories. So from the perspective of the instructor, the writing ideally serves as a measure of the students' learning.

A vital component of the lab segment of the course and the writing itself is the manual that each student receives. Contained within the manual is the objective of the lab, the procedures to be followed, and the key questions that students should focus on regarding the fundamental principles they must learn in order to grasp the meaning or importance of the lab experiment. In other words, the lab manual serves as a prompt, which helps to guide the learning as well as direct the writing. To clarify this point, here is a small excerpt of the manual:

Measure the time constant using the oscilloscope and compare it to the time constant calculated from the component values (RC). Change the oscilloscope setting and/or the frequency of the waveform in order to get a satisfactory measurement. Vary the period of the square wave and observe that the time constant of the waveform does not change, but if the period of the wave becomes short compared to the time constant of the circuit the capacitor does not fully charge or discharge. Sketch the waveforms of the capacitor fully and not fully charged. Explain why there is a difference.

As can be seen, in addition to the procedures, the manual clearly determines the significant observations and interpretations expected of the student. The relationship between the lab manual and the writing of the students will become much clearer and will be explored in more detail in the pages to follow.

In addition to the field, the tenor, or the relationships between the participants in EECE 201, must also be discussed. Since the writing takes place within an educational setting, the traditional roles of the student and teacher must be considered along with all the questions of authority that operate in such an environment. But of specific

importance to this study is the novice position of the student with respect to her attempts to enter a foreign discourse community. The student is attempting to move from a standing of relative unsophistication in terms of subject knowledge and technical discourse to a position where, not only through mastery of the subject matter but mastery of the discourse conventions as well, she becomes one of the critical mass of experts in the field.

In technical writing, the movement from novice to expert seems a bit problematic since the writer must be able to communicate in a depersonalized manner. Exerting one's authority within the conventions of technical discourse involves the elimination of one's ability to promote her own fresh and unique voice. If facts and data are the source of information and everyone works within the same confines of the controlled environment of the laboratory, then it is reasonable to assume that each written document would have the same authority if all students did indeed record and communicate the same data. Yet clearly, as the variety in the texts that will be analyzed demonstrates, this is not the case. Students -- as they attempt to promote themselves through discourse -- are left in the position of either becoming blind conformists to all the discourse conventions or conscious discerners of how to use objective facts and data as a source for creating credible knowledge statements. Within these two areas -- discourse conventions and intellectual investigation -- the student must orthographically fashion her role as a subject expert.

The third area of the social environment to be interpreted is the mode of communication. For this study, the mode refers to the written lab reports produced as part of the EECE 201 course. The previous chapter discussed the general features of the lab report, and many of the characteristics described by Maimon also apply to the reports written in EECE 201. There are, nonetheless, some distinctions that should be mentioned. For EECE 201, students are given the following instructions on the type of information that each segment of the report should contain:

Abstract: State the goals and objectives of the lab assignment. Describe briefly the process you used to obtain the data. Explain the results of your lab.

Introduction: Tell the reader the subject of your report. Explain the purpose of the experiment. Include the scope of the report. Include a plan of development.

Procedure: Explain all the measurements and calculations you completed for this lab. Show the circuits you constructed for this lab. Show graphs of the oscilloscope waveforms (if necessary) and explain these graphs. Provide headings and subheadings that help guide the reader through the process you used to complete the lab.

Analysis: Show that you have a clear understanding of the material. Explain, in detail, the results of your lab. Explain the significance of your results.

Conclusion: Restate the purpose of the lab. Restate the process of your experiment. Summarize the results of your lab.

Although the reports for EECE 201 contain five sections, this study will focus exclusively on two: the analysis and conclusion. Since one of the goals of this study is to move the discussion of technical writing beyond matters of form, the choice to analyze these two components is based on the interpretive tasks facing the students when writing

these sections. In the analysis and conclusion, students should comment on the results of the lab and should communicate the significance of these observations. With the course grounded in the students' ability to discover relationships between theory and practice, the communication of these relationships and their overall significance is instrumental in not only providing a means to verify the students' comprehension of the material but also to verify how students communicate as experts within the EECE 201 community.

With the social background of the writing understood, it is now possible to turn to the classifications that will be used to analyze the student texts. As with the social environment, Halliday's theory of language is a useful source here as well. Similar to his tri-partite division of the social environment, he also relegates language and the meaning inherent within it into three categories:

The ideational function refers to the speaker's meaning potential as an observer. It is the content function of language, language as "about something." It expresses the phenomena of the environment: the things -- creatures, objects, actions, events, qualities, states and relations -- of the world and our own consciousness.

The interpersonal component represents the speaker's meaning potential as an intruder. It is the participatory function of language, language as doing something. This is the component in which the speaker intrudes himself into the context of the situation, both expressing his own attitudes and judgments and seeking to influence the attitudes and behavior of others. It expresses the role relationships associated with the situation.

The textual component represents the speaker's text-forming potential; it is that which makes language relevant. (112-13)

The ideational function of language, according to Halliday, refers to the meaning of the content expressed and is where one finds the "specialized vocabulary" of the discourse community. For electrical engineers, the ideational function would include the specialized vocabulary that refers to the content and subject matter of the discipline. The interpersonal component includes the meanings inherent in language that reflect how the speaker participates within the community and the relationships among the community's members. This facet, in other words, represents how the speaker or writer expresses his judgments and how the language reflects this individual's position (e.g. expert or novice) within the communicative act. And finally, Halliday identifies the textual component, which refers to the coherence of the communication and the use of such linguistic tools as the coordinate conjunction and the transition.

These three components of language have direct correlation to the three components of the social environment, and it is the combination of the ideational with the field, the interpersonal with the tenor, and the textual with the mode that provides the categories that will be used to describe the features of the student texts that this study is concerned with. Also worthy of note is a study by Lester Faigley who used a similar three-step system to analyze a series of non-academic texts (231). Faigley's first category, the textual perspective, examined a document's readability in terms of its generic features and its specialized vocabulary. He additionally looked at the individual perspective, which focused on the choices made by the individual writer. And lastly, Faigley used the social perspective to classify what he viewed as the relationship of the text to other documents that had been previously produced.

All three of Faigley's areas of textual analysis bear some resemblance to those of Halliday's. There are clear similarities in the analysis of the textual dimension in terms of vocabulary and genre conventions and the social dimension with respect to the roles of

the individuals involved in the communication. There are, however, two important distinctions in Faigley's study that Halliday does not seem to mention. The individual perspective, according to Faigley includes a writer's choices. The idea of choice has significant importance when looked at in the context of discourse conventions and specifically in the case when the writer is considered a non-expert. The second significant contribution of Faigley's study is his acknowledgment that previous writing has some influence on the production of forthcoming documents. Earlier in this chapter, a reference was made to the importance of the lab manual. Within the context of the relationship between past and future documents, it will be shown that the lab manual has a significant impact on the production of future texts.

So with respect to the analysis for this study, there will be, like the previous categories mentioned, three areas of specific interest. The three categories are meant to provide specific areas in which to study the students' communicative competence with respect to the discourse conventions of the EECE 201 class. They will also demonstrate how the writing of these students reflects their position of authority regarding the communication of various interpretative statements. The three areas are as follows:

Specialized vocabulary: This area is concerned with the students' use of key terms and will focus on how the student expresses the "phenomena of the environment" and how the use of disciplinary language serves to create an authoritative and credible voice within the text.

Writer expression: Similar to Halliday's category of the interpersonal, this classification is also concerned with how the writer expresses attitudes and beliefs. And since this study is concerned with technical writing, this category will be more inclined to consider the effectiveness of the writer in expressing not only the facts and data but the interpretation of the results of the lab and their overall significance.

Knowledge statements: This category will be used to examine the students' ability to communicate the various relationships and observations discovered in the laboratory. As stated previously, since interpretation must be structured in some type of communication, an analysis of the texts can show how students attempt to construct comprehensive statements of the knowledge they have gained.

These three categories provide a space in which the topics deemed most important to this study can be discussed. A thorough and complete analysis could incorporate a range of other features such as the use of personal pronouns or the linguistic devices used to structure the text. But since the purpose of this analysis is to uncover how students are positioned by the generic conventions and how they consciously position themselves within the discourse, these three areas will prove to be of most value. Thus, the fundamental goal of the analysis is similar to the individual perspective characterized by Faigley. Given a discourse community that seems inherently fixated on the objective presentation of information and given a mode of writing instruction that seems relegated to issues of form and the acceptance of the conventions of a particular genre, it is logical to consider the range of choices available to a writer that can enhance or diminish his communicative position within the community.

Each of the student passages to be examined is reproduced precisely as it was written including any grammatical and content errors. Thus the communicative position of the student writer is faithfully represented. The first collection contains four student

texts, each from the first lab assignment of the semester and each coming from the analysis section of the lab report. Since the relationship between the lab manual to the writing has been identified as an important topic of analysis, the section of the manual pertaining to this sample of student texts is reproduced below:

Given the source voltage and the measured input resistance, calculate the value of the input current. Now, connect the power source to the circuit and measure the voltage across each of the components, then measure the current through each of the components. Compare your calculated value of the input current to the measured value. Prove that KVL and KCL are obeyed by showing that the sum of all voltages around any loop is zero, and that the sum of all currents entering any node is zero. Using the measured voltage across and the current through each element, calculate the power dissipated by each of the circuit elements and the total power supplied by the source. Now add the 10nf capacitor to the circuit as shown in Figure 3b. Again, measure the voltage across all the components and the current through the capacitor. Show that KVL and KCL are still satisfied. What is the apparent resistance of the capacitor for DC voltages and currents?

The manual clearly dictates the procedures that should be followed and also states the necessary questions and prompts that will guide the student toward achieving the learning objectives of the lab. Students are asked to make calculations, measurements, and comparisons and to prove the validity of a number of circuit theory laws.

Text A

First the circuit show in Figure I was constructed, and the input resistance at its two terminals was measured to be 0.4341.mA. The calculated values of the input current are 0.43mA. Next the power source was connected to the circuit and voltage was measured as well as the current across each of the components. Then the two values where compared. Then the user proved that KVL and KCL where obeyed. Then using the measured voltage across and current through each element, the calculated power dissipated by each of the circuit elements is expressed in Table III, and the total power supplied by the source is 2.25mW. Then a 10nf capacitor was added to the circuit and the voltage was measured across all of the components as well as the current through the capacitor. Then the user proved that KVL and KCL where still satisfied.

The obvious similarities between the language of the student text with that of the lab manual are quite clear. The likeness of the two texts not only in word choice but in syntax as well provides direct evidence for the earlier argument that the lab manual serves as an important source of invention. For example, the lab manual states that the student is to "connect the power source to the circuit and measure the voltage across each of the components, then measure the current through each of the components." When the student comments on this procedure, the text reads "next the power source was connected to the circuit and voltage was measured as well as the current across each of the components." All of the disciplinary language used in the lab manual is repeated by the student with the subtle changes in the syntax resulting from the student's adapting the sentences in the lab manual to the assigned passive constructions.

This pattern of repetition continues on throughout the student example, yet it is interesting to note the awkward structure that the student constructs in one instance. The manual states that "Using the measured voltage across and current through each element, calculate the power dissipated by each of the circuit elements and the total power

supplied by the source." When referring to this same process, the student writes, "Then using the measured voltage across and current through each element, the calculated power dissipated by each of the circuit elements is expressed in Table III, and the total power supplied by the source is 2.25mW." The only variation between the lab manual and the student text is the student's insertion of the recorded data. The awkwardness of the structure comes from the student's construction of "calculated power." This can be better understood by dropping the last clause of the sentence so that it reads, "Then using the measured voltage across and current through each element, the calculated power dissipated by each of the circuit elements is expressed in Table III." But with only a slight variation, the student's sentence can be constructed without the awkwardness: "Then using the measured voltage across and the current through each element, the power dissipated by each of the circuit elements was calculated and is expressed in Table III."

While this is only a slight variation to the student text, and one might argue a minor stylistic adjustment, the fact that the student relies heavily on the lab manual for invention and thus runs the risk of having the imitated structure unsuitable for the conventions of the lab report should not be overlooked. It is without surprise that students unfamiliar with writing a lab report would turn to a model such as the lab manual for a source of the language and sentence structure that seems suitable for their report. However, as has been frequently mentioned in this study, a fine distinction must be made between passive adherence to such models and instruction that will provide the students the means to generate not only their own discourse but their own thought as well.

If this student text is analyzed in terms of the norms of technical discourse, the text can be deemed correct because of its heavy reliance on the presentation of facts. The report consists of the statement of the procedures followed by the presentation of observed data. However, in terms of the student's self-involvement, this report -- because of its heavy reliance on the lab manual -- does not move beyond the prescribed procedures. The writing not only conforms to the language of the lab manual, but the student's thought process, with respect to the significance of the lab, is dictated by the manual as well. All of the questions that have been posed by the lab manual have been answered, yet the significance and any subsequent interpretation of these results -- as called for in the generic conventions of the analysis section -- are lacking.

A comparable reliance on the lab manual is also evident in the following student text:

Text B

Measure the voltage across each of the components, after connecting the power source to the circuit. Compare these values to the measured value. Using your measured voltage across and current through each element, calculate the power dissipated by each element and the total power supplied by each source. Add a 10nf capacitor to your breadboard to resemble the circuit shown in Figure 1(b). Measure again the voltage through the elements and the current through the capacitor. The voltage of the elements should be the same as before. The current through the capacitor was measured to be zero.

Because of the nearly identical language and syntax, this student report -- with the exception of the final sentence -- might easily be confused with the lab manual. The student of Text A had rearranged the sentences from the lab manual into the passive voice, but the student in Text B forgoes any of these modifications and keeps the sentence structure in the imperative. The key feature of analysis of Text B occurs --

much like Text A -- when the student diverges from the patterns established by the lab manual. In all but the final sentence, the persona of the writer can be equated to the individual who wrote the lab manual. Because of the use of imperatives, the student does not report on the procedures nor record the data from the experiment. This persona changes, however, in the final sentence, when the student takes on the role of someone reporting information. Also of note is the absence in this text of any mention of KVL and KCL. With such reliance on the lab manual and with an almost verbatim account of the procedures, one must question why this important aspect of the lab has been disregarded. Did the student accidentally omit this information or did he not complete or understand the procedure?

As with Text A, this student's reliance on the lab manual as an inventional technique creates a problem not only in terms of the syntax appropriate for the genre of the lab report but also with regard to the credibility of the student as a reporter and interpreter of the information. Also similar to Text A, Text B relies heavily on the presentation of facts and does not move beyond the procedures prescribed in the lab manual. These two texts illustrate the influence that the lab manual has not only in terms of choices of language and syntax but also the extent to which the students' thought processes seem confined by the dictates of the manual.

The passive adherence to the lab manual can be best illustrated by comparing the previous texts to the two that follow:

Text C

The voltage in each of the components and the current through the capacitor was calculated and tested. The results are listed in Table III. In the circuits Kirchoff's Voltage Law and Kirchoff's Current Law apply. The resistance through the capacitor is apparently infinite. This causes an open circuit and no current passes through the capacitor.

In comparison to the two aforementioned texts, Text C exhibits none of the severe reliance on the lab manual. There is naturally the same specialized vocabulary but none of the repeated syntax of the manual. Additionally, this student inserts the concept of an "open circuit" which had not been discussed in the previous two texts. So not only does the student of Text C move beyond strict adherence to the vocabulary and syntax of the lab manual, but he is also able to bring in concepts that have not been mentioned in the lab manual. Even more significant is the student's ability to communicate the relationship between an open circuit and the fact that no current will pass through the capacitor.

In the final sentence of the lab manual referred to for this grouping of texts, students are asked to measure the current through the capacitor and the apparent resistance of the capacitor after the 10nf capacitor is added to the circuit. The student of Text C records not only the measurement but the significance of the infinite resistance of the capacitor. The resistance is determined to be infinite, and the student proceeds to explain the meaning of such a measurement. As with Texts A and B, Text C also records the data asked for in the manual. However, Text C goes beyond the communication of the data and into the significance and interpretation of the data. With respect to Texts A and B, the lab manual does not call for an analysis of the relationship between the resistance of the capacitor and the current that passes through it. So with their strict adherence to the manual, it is logical that they would not include such an analysis. Text C not only exhibits none of the imitative tendencies but also includes the extended

interpretation that has not been specifically called for in the procedures section of the manual.

By stating this interpretation, the student of Text C moves beyond the confines of the manual and by doing so takes some risk. The risk entails not only questions over factual or incorrect interpretation but a slight venture away from an obedient acceptance and adherence to the discourse conventions established in the manual. The writers of Texts A and B are strict prescribers to the conventions and thus seemingly offer no chance of violating the language practices of the community. But as shown, when variation is required or attempted, some discrepancy with the previous communication and the discourse conventions in general results. Text C -- even though it strongly varies with the discourse constructions of the lab manual -- demonstrates how students can become proactive members not only of the discourse community but the discipline at large by conveying their own voice of authority in language and in thought as well.

Text D, the fourth text from laboratory number one, similarly conveys the student's authoritative stance:

Text D

This is the means by which the lab illustrates and in fact confirms basic circuit theory and the instrumentation used to determine these values. It is proven that KVL and KCL are valid. Both in the theoretical and experimental values in Table II, the summation of the voltages around the circuit and the summation of the currents entering each node is equal to zero. Now a 10nf capacitor must be added to Figure 1a to construct Figure 1b. The capacitor serves as an open circuit to a DC voltage so that when the same measurements are made to Figure 1b as were made to Figure 1a the same results should be attained. In fact they are.

As with Text C, the student of Text D also takes some risk in moving beyond mere imitation of the lab manual. The step-by-step procedures common in Texts A and B are replaced by statements of interpretation. And as with Text C, this student acknowledges the effects on the resulting measurements when adding the 10nf capacitor--an observation that was not asked for in the lab manual. And similar to Text C, Text D also refers to the concept of an open circuit, which is again something not discussed in the imitative patterns of either Text A or Text B.

By looking at these four texts with respect to the categories established for this analysis, it is possible to come away with some important insights regarding students' writing as they make their first attempt to communicate within the engineering discourse community. The reliance on the lab manual as a source of invention is clearly evident. Both Texts A and B plainly illustrate how the manual provides the key terms of the lab, the procedures to be followed, the main questions to be answered, and how all of these elements relate to the construction of the student texts. The reliance of some students on this material should come as no surprise when recognizing their inexperience with writing in the engineering discipline. However, as the earlier theoretical discussion has pointed out, students as well as writing instructors must be aware of the fine line between imitation of the discipline's conventions and the students' ability to create their own voices in order to become proactive members of the community. Additionally, since the writing for this course is part of the overall learning process, it is imperative for those teaching the writing component to recognize when the writing reflects observations, interpretations, and reasoning that indicate the student's awareness of significant relationships or associations. As Charles Bazerman points out "Disciplinary communities

require that their members are able to ask meaningful questions" (89). Getting students to approach their writing beyond concentrating on formal conventions to considering and exploring the relationships involved in the lab experiment is one way of helping students to actively participate within the discipline and which will enable them to not only ask the meaningful questions but answer them as well.

Also relevant to the issue of self-reliance are the following two texts taken from the conclusion sections of the first lab experiment:

Text E

The Basic Lab Tri-pack and Oscilloscope Lab was a success. All the data collected was proven to have a small percent difference. In analyzing the data collected the voltages and currents for the circuit proved that KVL and KCL because the current and voltage around the loop is 0. This lab also stressed the importance and the effect a capacitor has on a circuit. A capacitor has no effect on the circuit due to the fact that a capacitor is open-circuited in DC steady state. This lab also proves that the voltages in parallel resistors are the same in DC measurements. Using the O-scope showed that in order to get a more exact value of the rise time and fall time, it is best to use MAG. The lab introduced required working with new equipment and provided proof for many laws and theorems of circuits.

As indicated earlier, one of the generic conventions for an EECE 201 lab report conclusion is the summation of the results of the lab experiment. In this regard, Text E follows the discipline's practices. For example, the student explains how the circuit theory laws KVL and KCL were proven and states the effect of a capacitor on a circuit. The student takes an additional step beyond the presentation of the results concerning the capacitor's effect by noting the consequence of the open circuit. As with Texts C and D, this student also moves beyond the assigned procedures and prompts of the lab manual in order to note a significant relationship. The student in Text E also mentions specific results pertaining to voltages in parallel resistors and how to get the most accurate readings of rise time and fall time. From the standpoint of the generic conventions that the conclusion should summarize the experiment's results, one can claim that Text E follows these accepted language practices.

The categories earlier described can also give some further insight into the text. In terms of specialized vocabulary, the text clearly demonstrates the student's command of the terminology appropriate to this lab experiment. And as shown, the student also is willing to take a risk and construct a knowledge statement that goes beyond the confines of the assignment such as when the student refers to the relationship of the open circuit and the capacitor's effect on a circuit. However, there is one interesting statement that bears some consideration, and that is the student's opening comment claiming that the lab "was a success." One can argue that such a statement would violate scientific principles, since it reflects the personal judgments of the writer. Yet can this assertion be deemed as incorrect if one considers that all of the statements that follow are indeed representations of fact? The purpose of the lab was to set out to prove circuit theories, the effect of capacitors on circuits, voltages in parallel resistors, and the use of the oscilloscope. The student claims that everything was accomplished, so naturally with the objectives met, the lab can be considered a success. However, such a proclamation brings to mind David Borowick's claim that technical writing should be free of any judgmental words. "All pertinent information should be presented in a manner that can be objectively evaluated and concluded by the reader," writes Borowick. By claiming that the lab was a success,

the writer is--quite possibly unknowingly--influencing the judgment of the reader. Stating outright that the lab was a success rhetorically removes any objective evaluation of the discourse. With respect to this student's writing, it is possible to overemphasize the severity of this insertion of personal opinion. Yet if writing instruction in a specific discipline entails the acknowledgment of the discipline's language conventions and methods of address, then the instruction must include some mention of the potential that such statements as the one that opens Text E have on influencing readers and violating the standard of objectivity.

The second conclusion also offers some insight into the personal voice of the student writers along with the variation that is possible even within the perceived constraints of the lab report genre.

Text F

The purpose of this week's lab was to incorporate a feeling of understanding how to utilize important knowledge of research, the tools. The tools, the Tri-pack and Oscilloscope, were instrumental parts in finding information needed to understand relationships between currents, voltages, resistances and be able to exploit laws like Kirchoff's Voltage and Current laws. The lab served as a scope for learning not only how to use these tools, but familiarizing us with skills from computer programs needed to help the process or report writing. An important trait in engineering is being able to become a "researcher." Researchers not only know how to apply theoretical knowledge and fact, but they know how to use their tools to gain that information. This lab will serve as the stepping-stone for labs to come in the training of engineering.

One of the more striking aspects of this conclusion is its dissimilarity--in terms of the presentation of facts and data--with Text E, yet Text F does, nonetheless, summarize the results of the lab. The student indicates that the purpose of the experiment was to become familiarized with the laboratory equipment and notes the importance of the equipment in discovering various relationships between currents, voltages and circuit theory laws. And even while Text F neglects the inclusion of the specified data found in Text E, the writer of Text F does indeed take a risk in defining the significance of the laboratory experiment. "An important trait in engineering is being able to become a 'researcher,'"the student writes. "Researchers not only know how to apply theoretical knowledge and fact, but they know how to use their tools to gain that information." Instead of identifying specific findings in terms of the data -- the effect of capacitors, for example -- the student of Text F focuses on the overall significance of the laboratory experiment. For this student, the essential learning experience is the identification of the relationship between the engineer as a researcher and the researcher's ability to properly use his tools.

If both Text E and Text F are analyzed in terms of formal features of syntax, word choice, or cohesion, both texts can be understood relatively easily. Yet there is, as noted, a glaring variation in the contents of each. In terms of the discourse conventions of the technical community and the reliance on data and fact, Text E contains the more appropriate information. That being the case, then is Text F -- even while acknowledging the overall significance of the lab -- generically incorrect? One can argue about the form and style of Text F, but any concern over these stylistic features does nothing to change the content. The comparison of these two texts thus shows that the writing instruction does indeed stretch beyond concerns of style and into the areas of personal thought and expression.

If one of the major philosophies of writing instruction in general is to enable students to become proactive members of the discipline in which they are communicating, then instruction that strictly focuses on the formalized patterns of the genre must be looked at with some caution. In other words, should the instruction within the technical community be nothing more than preparing students to write conclusions that summarize and express the results through extensive use of facts, figures, and data? Text F does indeed state the significance of the lab--a convention prescribed to the conclusion--as seen by its writer. Instruction that insists that this student does not conform to the genre conventions and proposes that the conclusion should be written more along the conventional lines of Text E removes not only the student's voice but also the student's comprehension of the overall significance of that laboratory experiment. Teaching the discourse conventions is necessary to writing in the disciplines, but one must also weigh the cost of personal expression. A possible compromise could be reached that would allow the student of Text E to modify the conclusion while also maintaining what that student views as the significance of the experiment. A specific statement or two concerning the relationships between currents, resistances, and circuit laws discovered in the lab would provide the factual data that would further develop the conclusion while still maintaining the authority of the student's ownership of the text.

While Texts E and F are from the first lab and thus represent students' initial attempts to recognize the generic conventions, there is, as the writing process continues, a gradual awareness that takes place as students become more aware of the acceptable forms of technical communication. As they move through the series of writing assignments, the students become increasingly familiar with the form of the lab report as well as the contents of each section. So if teaching the conventions of form is the determination of writing instruction and the final definition of writing knowledge, then it would seem that once students are cognizant of the genre and the discourse conventions then writing instruction would no longer be needed. However, the following two conclusions from the third laboratory, while more along the lines of following the discourse conventions, do indeed serve to show that there is a continued need for instruction:

Text G

The purpose of this lab is achieved. It provides a complete understanding of V_{rms} , V_p and V_{pp} in both AC and DC states and a combination of AC and DC states. The lab also illustrates which laboratory instruments are used to measure which type of voltage and how to mathematically convert from one type of voltage to another. Part one theoretically and experimentally obtains the voltage properties for AC sources of different waveforms and DC offset AC sources of different waveforms. The application of these congruent theoretical and experimental results in deriving other properties including power give support to an assumption that although the same peak voltage is applied, the waveform itself determines the properties of voltage and other elements of the circuit derived from voltage. Part two further explores waveforms and how they are affected by diodes and capacitors. It is found that the diodes only allow a positive current and thus a positive voltage in the circuit while capacitors create an exponential waveform out of a sinusoidal waveform. All experimental results were concurrent with the theoretical results in various areas of analysis experimentation.

This student starts the conclusion in a similar fashion to that of Text E, which opened with the proclamation that the lab was a success. According to the writer of Text G, the

purpose of the lab was "achieved," since the objective was to garner a "complete understanding of V_{rms} , V_p and V_{pp} in both AC and DC states and a combination of AC and DC states." In the initial statements of Text G, the student, knowingly or not, has rhetorically created a credible persona. Based on the language alone, the reporter of the information is completely knowledgeable of all the procedures and results encountered in the lab.

From a generic consideration, this text, much like Text E, rests heavily on the presentation of facts and data. What is equally important is the student's use of particular knowledge statements. After summarizing the purpose and collected data, the student indicates the specific relationships found involving waveforms and the effects of diodes and capacitors. The student continues with the created persona of an expert which is clearly evident in the language of the following statement: "The application of these congruent theoretical and experimental results in deriving other properties including power give support to the assumption that although the same peak voltage is applied, the waveform itself determines the properties of voltage and other elements of the circuit derived from voltage." This is indeed a rather lengthy sentence and one that contains a significant amount of information. And in the context of the discourse conventions, which include the importance of clarity and conciseness, such a sentence would border on being something other than concise. When reading this sentence I cannot help but recall the study by David Bartholomae in which he examines student writers' attempts to imitate academic discourse in order to position themselves as an equal and not as a student (591).

The role that the student of Text G seems to attain in this rather lengthy sentence is one of authority similar to that created in the opening comments of the conclusion. The complete understanding of the lab has been achieved, and in this one sentence the student is attempting to communicate why an assumption is supported by an observation done in the lab. An interesting difference can be noted between what can be considered as the technical and non-technical parts of the sentence. The technical language includes the following: "although the same peak voltage is applied, the waveform itself determines the properties of voltage and other elements of the circuit derived from voltage." Viewed this way, the sentence does not carry any of the obfuscation that appears in the lengthy version. However, when reviewing the non-technical part of the sentence, the cloudiness begins to emerge: "The application of these congruent theoretical and experimental results in deriving other properties give support to an assumption." While not completely misunderstandable, the sentence is constructed with what can be considered as rather dense lexical jargon. By splitting the sentence into two parts, the clarity of the expression of the technical language can be seen when compared to the rather confusing presentation of the non-technical information. The student can express technical concepts in a clear manner but chooses to use rather superfluous vocabulary when it comes to expressing a non-technical thought. This same correlation between the voice of authority and the choice of words continues in the final sentence. The last noun phrase -- analysis experimentation -- is a unique and interesting combination and echoes the extraneous word choice found in the sentence just described. As with other matters of word choice, this particular combination seems more in line with the creation and support of the credible persona rather than with the clear communication of facts or interpretation.

So even while the generic conventions are followed -- which serves in part to create a credible member of the community -- the student somewhat undercuts this attempt by, either intentionally or not, trying to establish a voice of authority through the use of what can be considered unnecessary language. The student sacrifices clarity for language that appears to create credibility and authority.

Text G demonstrates how students use language as a means to establish authority yet -- again intentionally or not -- students also construct statements that can undermine this position as seen in the following conclusion:

Text H

The purpose of this lab was to gain an understanding of voltages and power in a circuit. More specifically the peak and rms voltages, and how different waveforms will affect the circuit in terms of power and voltage. This goal was achieved by building a simple circuit and then measuring the AC and DC voltage across a resistor. This was done for three different waveforms sine, triangle, and square and then once again for each wave with the voltage offset by two volts. It was found that a square wave delivered the most power followed by the sine wave and then lastly the triangle wave. This finding is thought to be caused because the square wave is at its peak voltage for the maximum amount of time, as represented by the oscilloscope, followed by the sine wave and then lastly the triangle wave. There was a variation between the RMS voltages calculated using equation 1 and the RMS voltage using equations 2 through 12. This was thought to be caused by human error. The second circuit with the diode and capacitor demonstrated the effect they have on a circuit. The diode prevents the voltage from dropping below zero while the capacitor makes the voltage peak to voltage zero transition more gradual. This lab demonstrated how power and voltage behave in a circuit and how they can be analyzed and solved for using a function generator, an oscilloscope, and a DMM.

The student of Text H is also true to the technical discourse conventions by presenting facts and data. Additionally, the student goes beyond mere reporting of the data and produces knowledge statements that serve to further develop and interpret the findings. How these statements are constructed, however, diminishes the credibility of the information given. For example, the student writes that "It was found that a square wave delivered the most power," a finding "thought to be caused because the square wave is at its peak voltage for the maximum amount of time." Whether the student is conscious of it or not, the use of the phrase "thought to be caused" gives rise to issues of believability. Such a construction gives the perception that the writer is not sure of the relationship and the resulting assumption and subsequently provides the context in which the reader can also assign some disbelief not only to the message but to the messenger as well. With respect to the student in this case, there may indeed be some doubt as to the relationship between the maximum power delivered by the square wave and the reading on the oscilloscope. But students must also be aware of how such constructions of "hedging" and the like can influence their position as a knowledge expert.

In addition, the student also repeats the construction of "thought to be caused by" when referring to the variation between calculations that were made. Similar to the previous instance, the student admits that the variation "was thought to be caused by human error" which casts some question as to the accuracy of the interpretation. Human error may have been the cause of the miscalculation, or some other factor may be involved. One method that the student could have used to counter this sort of hedging is to consider and then acknowledge other potential sources for the error. Not only would this rhetorically negate the "thought to be caused by" construction, but an investigation and reporting of other possible causes can serve to heighten the student's subject knowledge as well. This would require the student to "think outside the box" of the lab manual and seek observations and interpretations that may not be readily and easily available. For the writing instructor then, the question becomes why is there doubt on the

part of the student concerning this conclusion, and how can this doubt then be expressed in the writing.

The issue of admitting human error is an additional cause of concern not only for the students but for the writing instructor as well. It may indeed be human nature, but the acceptance of personal responsibility seems at times to be somewhat of a challenge not only to engineers but to a large portion of the population. Yet for students, admitting an error takes on added dimensions. Within the academic environment, students are continuously evaluated on their success, and any acknowledgment of an error or mistake runs counter to this culture. Admitting that a misunderstanding occurred within the context of a classroom discussion is one thing, but admitting a mistake on an assignment that will be graded seems inherently inconsistent. However, within the technical community, the admittance of human error is not only an essential part of the empiricist endeavor but is a vital ethical component of the discipline as well. This double-bind situation facing students is illustrated in the following passage:

Text I

The error that occurred was due to the fact that the actual resistance was slightly different and the voltage and current sources were not set to the actual voltage and current needed. Error also occurred when measuring the voltage and current because the voltage and current sources heated the resistor, which changed its resistance and made it difficult to record the voltage and current. Besides the small error the lab was a success.

The student of this text admits to two errors, with the second error directly corresponding to the accuracy of the measurements. Even while acknowledging these mistakes, the student admits in the final sentence that the lab was still a success. Not only was the lab still successful, but the mistakes, according to the student, were "small." The judgment of assigning the severity of the error has been made by the student in an effort to maintain control not only over the authoritative position of the writer but the overall validity of the experiment. Rhetorically, the last sentence contradicts the admission of the error and any possible severity that the reader may assign to these mistakes with respect to the overall evaluation of the lab. The student accurately records the error yet diminishes its potential impact on his overall performance as a writer and as an expert in the discipline by claiming that the error was negligible. The error may indeed have had little impact on the overall significance of the experiment, but writing instructors must be aware of the complex situation students face with the prospect of admitting that they have indeed committed some type of mistake.

A second example associated with human error and the student's expression of it also signifies a somewhat precarious situation:

Text J

By the use of waveforms that were observed on the oscilloscope along with the waveforms found using PSpice, help with the familiarization of both of these tools. It was found that the capacitor voltage lags the source voltage, while the inductor leads it. The error associated with this problem is due to human error on the part of reading the oscilloscope and the estimations that were taken by that person.

This student also openly admits that human error occurred, yet what is interesting is the assignment of blame to some unnamed "that person." Since the experiments are conducted in pairs, this student's lab partner could have been responsible for the

miscalculation. And because of the generic restraints restricting the use of personal pronouns, the student of Text J was linguistically unable to come up with the means of identifying the source of the error. So what results is a section of the report that can be analyzed along the lines of two identities. On one hand, there is the student writer who is recording the data and acknowledging the occurrence of the error. And then there is the individual--separate from the persona of the writer, even though they may be one in the same--who committed the error. Whatever the reason, the effects of this construction need to be considered.

While these texts represent only a small fraction of the total amount of writing done in EECE 201, they do provide some insight into the range of questions and issues to ponder when considering what is involved in writing within this particular class and within the technical community as a whole. Within any discipline, participants obviously must be able to communicate with each other. From this standpoint, there is some value in teaching students who wish to participate within their chosen field the values and means of communication that the discipline deems acceptable. Yet by structuring the instruction solely along the lines of these discourse conventions, the potential exists to disregard individuality for the sake of conforming to the accepted guidelines. Given the connection between thought and language, instruction that blindly limits the creativity of language use creates an environment that can also limit the creativity of the intellectual investigation that is so much a part of the educational experience.

CONCLUSION

This study began by noting the often-discussed relationship in composition between theory and practice. And based upon Ross Winterowd's assertion that any instruction must be rooted in theory in order to guide its direction, I have intended to formulate--through the assistance of rhetorical and composition theories--not so much a mode of composition instruction but an approach by which to understand the actual writing done in one disciplinary environment. Theory can indeed inform the writing process, as it can also serve as a way to comprehend the texts produced within a particular setting.

The properties that have long been assigned to technical writing -- objectivity, clarity, and conciseness -- and the fundamental belief systems inherent within the technical community that motivate these traditional discourse conventions have been central to this discussion. An understanding of technical writing could have been developed solely from elaborating on these traditional values where the principles of form and objectivity -- fundamental to a Current-Traditional approach to writing instruction -- would have provided an accurate, although limited, assessment of the technical writing environment. An approach that rested heavily on integrating theories of genre studies and discourse communities would have likewise resulted in a credible but incomplete description. By broadening the theoretical discussion to incorporate Current-Traditionalism, Expressionism, and New Rhetoric as a means of understanding technical writing, this study has, while acknowledging the claims of the technical discourse community and its calls for clarity and objectivity, shown the importance on the connection between thought and language and students' self-conscious attempts to situate themselves as experts within the technical community.

All three of these well-established rhetorical theories contribute in some form to an understanding of technical writing. With the belief that technical writing instruction should be relegated to matters of clarity and form, it was essential to demonstrate that, while these conventions may be valid, the act of writing involves more than the ability to use the proper number of words or to be able to position the words in just the right place. Of most importance to the entire discussion was the process of student socialization and how communication creates and also disrupts the students' ability to situate themselves as recognized members of the engineering community. Students themselves must become aware that the act of writing within the technical community consists of more than just putting the proper information into the proper generic boxes. This study in no way neglects the importance of clear writing nor the importance of recognizing the distinctive features of a particular genre, which are indeed crucial skills to master if one wishes to successfully communicate within the disciplinary community. Yet there is unquestionably much more invested in the act of communication than following the formalized conventions.

A central argument that guided the rhetorical analysis was the issue of student control with regard to the prescribed nature of genres. As was demonstrated, a variation existed among the students between what can be considered mimicry of the vocabulary, syntax, and thought of the lab manual and a fresh and personal display of discourse and intellectual curiosity. Even though the perception may be that genres and their conventions curtail individual expression, the samples analyzed in this study reveal that there are indeed opportunities for individual exploration. And while the variety of

expression with respect to vocabulary and style may be somewhat limited, the variety and quality of thought expressed are not confined to certain generic conventions. In this sense, the writing instruction, although valid in asserting the need for proper form, also needs to emphasize the need for constructive and penetrating thought.

One of the particular areas of concern was the students' ability to produce so-called knowledge statements. In order to become proactive members of the community and advance the interests of the discipline, a member must continue to produce, confirm, or adapt new statements of knowledge. Reporting the data is only one step. Being able to identify its significance and turn the information into a useful statement of knowledge is another. If technical writing is viewed as nothing more than the transmittal of data, then such information could be communicated -- and I would argue much more efficiently -- by the use of tables and graphs. Yet the role of language within technical communication is essential to creation, interpretation, and communication of disciplinary knowledge. As instructors, we do not know -- unless we are blessed with unbelievable powers of perception -- if a student may find herself one day in the position to advance some new statement of knowledge or some new interpretation. But not training her to realize the union between thought and language and the role that discourse plays in promoting new knowledge would be nothing short of a missed educational and intellectual opportunity for both teacher and student.

The relationship between formal correctness and thinking well has been a significant part of not only this study but of many discussions on writing. By moving the emphasis away from formal correctness to the personal concerns of the writer, one can very easily argue that this type of writing experience results in not only a deeper cognitive experience for the writer but a more enjoyable one as well. In their book, *Rhetorical Traditions and the Teaching of Writing*, C.H. Knoblauch and Lil Brannon claim that "writing becomes superficially difficult when teachers insist that it be done *this* way rather than that; it also becomes a ceremonial exercise when its formal appearance is given a higher priority than what it says" (32-33). They continue by adding that "an emphasis on conventions instead of meaning implies that the conventions matter more than anything else" (47). Such statements can readily apply to the technical discourse community. Because of the stress on objectivity and the reliance on facts and data as the transmitters of information, the natural inclination for teachers and students alike is to concentrate on the conventions. And since genres are a particular and necessary feature of the instruction, the emphasis placed on mastering these conventions is heightened even further. Yet by neglecting the thought of the individual writer, the instruction and the subsequent process of writing does indeed become merely an exercise in filling in the blanks.

With having little incentive to write other than learning the proper form and participating within a discipline that sometimes views writing as a separate process from the production of knowledge, students frequently question the worth of writing in relation to acquiring the knowledge of the subject matter. Students from the EECE 201 class often voiced their concerns over the tediousness of the writing process and of the seemingly disproportionate amount of time spent on something that apparently has no significance to their education except to prepare them to "properly communicate" in a professional work environment. Learning to write becomes nothing more than a vocational endeavor and not something inherently tied to either the laboratory objectives or the overall educational experience. But by shifting some of the emphasis away from conventions to the thoughtful exploration that coincides with good writing, movement

can then be made to demonstrate how the writing in the class is indeed related to and not separate from the laboratory experiment.

And since the correlation between form and content has been a defining topic in this discussion, some final mention regarding the issue of subject knowledge and writing knowledge must be made. The question was raised earlier pertaining to the definition of writing knowledge and the position that a writing instructor assumes when teaching in an unfamiliar discipline. While teaching form may be somewhat universal and applicable to any discipline no matter the level of the teacher's disciplinary knowledge, one may reasonably question this person's ability to teach thinking strategies in such unfamiliar territory. I do not intend to assert that a writing instructor has the ability to verify, dispute, or correct certain statements with respect to their content. Rather, teaching thinking strategies implies that the writing instructor provides the student with the self-awareness that allows the student to use language as a source of intellectual exploration. As the rhetorical analysis of the EECE 201 texts demonstrated, even within the confines of the lab report the potential exists for such exploration and personal choice. Writing instructors should reveal and encourage how personal choices with respect to language influence the effectiveness of a student's persona. Such instruction moves the writing away from the emphasis on form and gives the student an invested interest not only in terms of the content and thought in the communication but also in the communication's expression of the student as someone who can be perceived as an expert within the community. In their discussion of writing in the disciplines, David Kaufer and Richard Young state the following:

Neither the subject matter expert nor the writing expert is likely to be expert in the writing in specialized areas--that is "expert" in the sense of having both an ability to carry out successfully the rhetorical tasks associated with a subject matter discipline and an understanding of and ability to articulate reasons for the success. (74).

The student -- through proper instruction -- becomes the "expert" when he is able to not only carry out the rhetorical task but also to understand the reasons for its success. By promoting the concern for thoughtful exploration and the awareness of the effects of rhetorical choice, the writing instructor -- no matter what discipline she may find herself in, can indeed serve a vital role in making the student the expert

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