

# Embracing the Other Culture: Bridging the Gap Between the Writing Center and Engineering Studies

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Literature and experience both suggest that accommodating engineering students in the writing center presents a unique set of challenges that are often daunting to writing center practitioners, as scientific modes of thought are often vastly different in style and substance than those in the humanities. By synthesizing personal experience, an interview with an expert in the professional and academic engineering field, and literature, this article explores engineering identities to inform writing center practitioners' practices as they engage with engineering students. This study asserts that the identity-centric approach that is commonly incorporated into writing center pedagogy can be used with engineering clients with same effectiveness, provided that the writing center becomes more acquainted with engineering identities.

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## Introduction

It was in my semester of training for the writing center, during a futile attempt to explain d'Alembert's paradox to my classmates, that I began to observe a troubling trend that permeates not only the writing center, but academia as a whole. Met with confused stares from my colleagues as I doubled back to explain words that had become natural facets of my engineering vocabulary, I began to suspect that the growing specialization of education has, perhaps unintentionally, bred a sort of "siloed" thinking among students and faculty, where the scope of one's understanding is deeper, perhaps, but more confined to one's specific study. It was Charles Percy Snow's *The Two Cultures* that first confirmed for me that this trend was real and omnipresent, and not simply an imagined phenomenon invented to justify my inability to explain a fundamental idea of

aerodynamics (though I may not be as proficient as I would hope to be in explaining such things). Interactions such as these, Snow asserts, are often laden with "(particularly among the young) hostility and dislike, but most of all lack of understanding" (4). Though hostility wasn't a present feature of that conversation, my classmates and I noticed a growing frustration at our inability to understand each other.

During my time as a tutor, there have been several occasions when I was asked by a colleague to take over a session because the subject matter of the paper was scientific. Though, as I recall, these sessions were not particularly difficult, it was suggested to me by my colleagues that because of my engineering training, I was the only tutor available who was suited to handle the session. Though the sessions concluded without issue, I was left wondering why my intervention was considered necessary—my co-workers clearly

didn't feel adequately trained or informed to handle these sessions properly.

To better understand how tutors can help engineering clients with their writing, I set out to investigate the rhetorical features of engineering writing and engineering identities, and analyze them using both my experience as a writer, tutor, and engineering student.

## **Review of Literature**

### ***The Diverging Cultures of Engineering and Writing***

The first step in my investigation seemed clear: I needed to understand the differences between the identities of writing tutors and engineers. The way these two cultures (think academic tribes with different histories, customs, and values) process knowledge and construct identity is undeniably different enough to impede cross-cultural communication. Though Snow more broadly describes the cultures of literary scholars and scientists, the divergence of these two intellectual groups was the same divergence between the writing tutor and engineering identity. Most of the writing tutors from my own center, and from centers I've encountered at conferences, were recruited from the humanities, a category Snow defines as literary scholars, and many are not accustomed to the thinking of the scientists. Thus, the "gulf of mutual incomprehension" he describes is the very same gulf that prevents most writing center tutors from feeling comfortable with engineering clients.

This mutual incomprehension may be in part due to differences in how scientists and literary scholars understand and produce knowledge. Joseph Jeyaraj describes an important distinction between *knowing* and *knowing about* something. *Knowing* is a

subjective experience in which one must acquire first-hand knowledge, while *knowing about* is an experience that can be more readily expressed as a sum of "subsidiaries"—attributes and data that are more readily expressible (194). To *know about* a tornado is to know its category, wind-speed, trajectory, etc., while to *know* a tornado is to have been close enough to one to experience it. Engineers, he argues, tend to prefer knowing *about* things—to understand them in ways that are quantifiable and easily expressed in modes of direct communication, not because knowing is unnecessary, but because their profession demands exact detail: "Bridges need to hold," he states, "airplanes need to fly, and buildings need to stand. Any structural failures, because of faulty judgment caused by misunderstanding the rules and instructions governing subject matter, will have costly consequences" (196–97). By this, Jeyaraj means that engineering communication is removed from the realm of *knowing*, and placed more securely in the realm of *knowing about*, because that form of communication is measurable, observable, and lends itself to exact certainty and detail where the production or use of physical (mechanical, electrical, chemical, etc.) systems is concerned. Whereas some may see the humanities as an endeavor to understand humanity's individual and social natures, which requires an understanding of subjective experience, those in the sciences seek to gain knowledge about the nature of the universe, or use what knowledge exists to improve life here on earth. Thus, one of the fundamental trademarks of scientific thought (particularly in mathematics, physics, or chemistry) is that things can often be understood outside of the human experience—the theory of gravity, for example, should hold true regardless of whether anyone notices or

not. Jeyaraj does, however, assert that neither culture is complete without both types of understanding. Humanists may excel in knowing things and scientists may excel in knowing about things, but “scientists ... have a personal hunch or a sense of plausibility that enables them to look at the right data for making discoveries” (193), just as humanists must often gather quantifiable data to support their arguments.

Even in professional fields like the social sciences where intellectual progress and understanding rely on both qualitative and quantitative methods of inquiry, Gary Goetz and James Mahoney note that “Communication within a given culture tends to be fluid and productive. Communication across cultures, however, tends to be difficult and marked by misunderstanding” (1). They reject the popular oversimplification that “quantitative-qualitative distinction revolves around the use of numbers versus words” (2), though, as Lisa DeTora argues, scientists must have greater “numerical literacy” and aptitude for balancing “visual, quantitative and textual information” (50). The root of the two modes of inquiry, Goetz and Mahoney state, are actually two different mathematical approaches:

Instead, we see differences in basic orientations to research, such as whether one mainly uses within-case analysis to make inferences about individual cases (as qualitative researchers do) or whether one mainly uses cross-case analysis to make inferences about populations (as quantitative researchers do). We even suggest that the two traditions are best understood as drawing on alternative mathematical foundations: quantitative research is grounded in inferential statistics (i.e., probability and statistical

theory), whereas qualitative research is (often implicitly) rooted in logic and set theory. (2)

Though a fear of navigating another culture’s “language” (humanists may have an anxiety about numbers, just as some engineers I’ve encountered have an anxiety about lengthy paragraphs on humanistic subjects) may be the surface issue for many cross-disciplinary interactions, and it may well be an important one, it is not the sole cause of miscommunication and mistrust between cultures. Both cultures, Snow asserts, are driven by the same basic feelings and intentions—curiosity demands a search for answers, ambition and pride demand a feeling of contribution to the greater work of mankind—but the two cultures have strikingly different ways of producing and understanding knowledge. This lack of mutual understanding is what plays out in the classic, anecdotal failed engineering session in the writing center.

### ***The Writing Laboratory***

Writing can sometimes be mistaken as a tool more suited to more qualitative, humanistic pursuits, but as Kenneth Bruffee suggests, thought is merely “internalized conversation”, which consequently would make writing “re-externalized conversation” (329). If conversation and thought are suited to both qualitative and quantitative inquiry, one might imagine that writing would also be suitable for either form of thought. Ideally, the writing center is an institution that observes and assists with all forms of writing, and has the potential to improve both humanistic and scientific literacy in both tutors and clients.

The writing center, as described by Neil Lerner, would be most effective if thought

of—and used—as a laboratory for writing instruction where writing is learned through discussion and experimentation. In such a setting, writers learn more from guided practice than from lecture; through “problem solving, critical thinking, an ease with the unknown, and persistence in the face of frequent failure” (5), students gain a practical understanding of writing that can only be acquired through practice.

In “Integrating Communication into Engineering Curricula,” Julie Dyke Ford chronicles the New Mexico Institute of Mining and Technology’s attempts to synthesize writing and engineering-design curricula to better prepare engineering students for oral and written communication requirements of the professional world. In her description of her technical writing course, she outlines laboratory methods of experimentation and revision in the context of engineering design:

In my class, the students were required to apply a process approach towards communication that resulted in early and ample planning and revision of texts they were required to produce for the design clinic. As a result, the technical writing course helped reinforce the importance of communication as part of engineering process. Rather than provide instructions on how to write common engineering genres, my focus was more concerned with facilitating the kind of mediated social interaction considered “central to situated learning.” (n. pag.)

The first primary feature of this successful program was that the students were learning interdisciplinary skills (if writing is assumed to exist outside the typical engineering curriculum) in the context of their

own studies—meaning that they were exposed to manageable portions of the other culture as it related to their own. Second, their instruction occurred in a social setting: “Teams were cued to consider the brainstorming techniques they had been exposed to in prior writing classes, such as mind mapping, clustering, linking, and outlining” (Ford, n. pag.). As a result, students could collaborate productively, building and revising presentations using the same sort of peer review that is used in the writing center.

Writing center scholars have also documented their efforts to work with engineering students and faculty. Rebecca Nowacek and Bradley Hughes discuss their writing center’s efforts to reach out to the engineering studies department at their institution: “Working together with our center, this (engineering) colleague planned an impressive sequence of scaffolded assignments to help first-semester juniors learn to read and understand primary scientific literature. ... Through this collaboration, our colleague’s understanding of threshold concepts deepened, as did our writing center staff’s understanding of how these concepts play out in this particular field of engineering” (181). Though this description summarizes some of the potential strategies of improving a staff’s familiarity with engineering (workshops, lesson plans, assignments), it is at best a vague description of the implementation of those strategies that does not discuss the details of the work or the metrics by which success was measured.

Though the writing center’s peer-centric approach to learning should make it ideal for bridging the gap between the engineering and writing/writing tutor identity, there are a few challenges that the writing center faces

when it comes to these cross-cultural interactions—namely that there are too few of these encounters, and that they are sometimes not as productive as desired. Writing center tutors often “[wonder] if [they] will be able to understand the intricate, jargon-laden draft” and “[wonder] if [they] will give appropriate advice...or think of anything to say at all” (Johnson, Burton, and Clark 391). In some cases, the density of scientific language creates a barrier between tutor and client that’s reinforced, at least partially, by math or science-induced anxiety.

Reaching out to engineering students may be easier than most writing tutors believe, however. Despite the differences in the values of quantitative and qualitative data, as well as the jargon and math-heavy nature of most scientific writing, the core concept of the writing is the same: that the writer is trying to convince the reader. Dorothy Winsor’s analysis of engineering writing asserts that its purpose is “trying to figure out how to make a sensible, clear story out of the data” (67). Each data set (and by extension, its charts, graphs, and pictures) can be best understood as evidence in the making of an argument. As most writing center tutors know, the use of appropriate evidence is crucial to making an argument; thus, it is common and sometimes necessary in engineering writing, to “[rearrange] the facts for the sake of the ‘story’” (67). Even without the technical knowledge of the engineer, the writing tutor (by nature of their work) should be able to assist their client with the selection of appropriate data—and their analysis—simply by asking how the data logically contribute to their own argument.

Though the literature analyzing the distance between engineering studies and the writing center (or rather, writing in general)

is abundant, little progress seems to have been made in reaching out to engineering students, or in tackling the difficulties of an engineering session. Johnson, Burton, and Clark discuss strategies for successful writing center interactions between cultures, but focus more on verbal cues and rhetorical strategies—mentioning only that mutual incomprehension puts the tutor in a better position to have “an open and equal dialogue,” rather than being “controlling and assertive” (392). Though Melissa Ianetta and Lauren Fitzgerald describe a “debate about the relative merits of generalist tutors, who lack knowledge of the writer’s target discipline and genre, and specialist tutors, who have such knowledge” (148), the unavailability of specialist tutoring in some writing centers makes the investigation of its benefits nearly impossible. Ford discusses how a writing fellows program can be constructed, but those findings and methods do not appear to have been applied to writing centers. Nowacek and Hughes, in a similar vein, explore their writing center’s work with their institution’s engineering department, but are not explicit enough to offer substantial assistance in understanding how to handle the engineering session.

## Methods

To better understand engineering writing and engineering identity, and their role in the writing center session, I recorded and transcribed two interviews with faculty members, one of which was used for this IRB-approved study. The questions were designed to illuminate the principles behind the creation of engineering writing assignments, and how these assignments then contribute to the creation of engineering identity.

The participant featured here, Dr. Kevin Craig, is a mechanical engineering professor at Hofstra University. His experience as a professional engineer and his unique position as the instructor for the upper-division engineering classes in the mechanical engineering track give him a thorough understanding of the engineering identity, as well as a critical role in shaping it, making him an ideal candidate for representing engineering identities.

Craig was asked to answer a series of questions (see Appendix) about writing in his classroom and professional engineering settings. The responses to the interview questions were recorded and transcribed. These responses were used with the previous research literature to build and substantiate claims about the key features of writing within the disciplines, including but not limited to writing conventions, organization and syntax, motivations, the prominence of co-authorship, the balance of visual data, and the use of quantitative/qualitative data. Any related follow-up questions and their responses have also been recorded and transcribed for potential use.

In proper engineering practice, it is necessary to make a note of the underlying assumptions at the foundation of any study. Such assumptions can simplify the solution process for a problem, but also reduce the applicable scope of the solution, confining the solution to a more specific context. Clearly stating assumptions is critical, as it allows both the writer and the reader to better understand the process of data collection and analysis, as well as the potential limitations of the writer's work. For that reason, I list the following assumptions that I made in the analysis of engineering identity, and my reasons for making them:

- My interview subject has enough experience in his field to qualify him as representative of the engineering community for this study—he has the highest degree in his field, has over a decade of professional experience, and has published articles and academic papers during his career.
- Writing centers are often staffed with non-STEM students—as substantiated by the range of majors of the writing center staff at my own university.

I then analyzed interview responses and synthesized them with literature and personal experience to generate a more complete understanding of engineering identity and engineering writing, and how those two concepts present themselves in the writing center.

There are limitations to this study—most notably, that it relies heavily on only one interview for raw data and autoethnographic analysis. While this facilitates the collection and analysis of qualitative data, it also limits the scope of the study and reduces the context of the findings to the institution at which the interviews were conducted. These limitations, however, can be reduced by conducting further research, either in the form of a replication of this study, or by more quantitative methods.

## Results

In my discussion with Craig, it became clear that one of the primary focuses of engineering writing is to make concepts and conclusions as clear as possible to expert and non-expert alike, and to put mathematics in a less prominent position. He says:

The key is to make whatever you're presenting as clear and concise and simple—without being overly simple—as possible, knowing your audience is key to [writing]—so even if your audience is perceived as experts in the field, you still want to make your presentation almost detail-free, focus on concepts and general understanding, rather than detail mathematics and engineering.

This is not to say that the audience is irrelevant—the audience can determine other features—but regardless of the audience, the writer is often expected to make concepts clear to a more universal audience. This, in the context of a writing center session, would mean that discussing a scientific concept in more general terms would not just be helpful for the tutor, but may also be necessary for the writer. This also means that numbers and formulas alone are not significant without explanation of what they mean. In other words, the primary goal of STEM writing is to explain in the simplest, yet most accurate, way possible what the concept is and why it is so—the mathematics are not the presentation, merely the proof behind the presentation. They should of course be present, and in a legible fashion, but could either be confined to an appendix, or be placed alongside written explanations of what the equations mean.

Another main idea that Craig discussed gives additional insight into the purposes of engineering writing:

Yeah, [the students are] not doing it for me, they're doing it for themselves, so they're doing it for themselves as an example of their work, and so they're not doing it for me for a grade, they're doing it for them to get practice to be better

engineers and to have examples of the quality of their work that they can use for jobs and interviews and things like that.

The uses for interviews aside, the writing intensive projects done by engineering students often demand that the student provide justification for an engineering design or decision. This forces the engineering student to go beyond pure mathematical reasoning and provide context for the equations that are used in the design. As a result, engineers become accustomed to thinking more critically and creatively about design problems, rather than simply repurposing old equations for contemporary problems.

Essentially, engineering writing exists to explain these concepts both to a wide audience and also to the engineer. Presentation is important in the writing, which is why the appropriate balance of visual and written information is critical, but comprehension both for the engineer and their audience is even more so. The writing then bridges the information from the engineer, who can be seen as a content specialist, to the non-engineer, who is a non-specialist, while simultaneously reinforcing good engineering practice in the engineer by demanding more thorough exploration of the engineering process.

## Discussion

The first step to improving sessions between tutors and clients is a more universal one: The writing center should cultivate discussion with all departments, including and perhaps especially those in the sciences. Hofstra's Writing Center is under the administrative umbrella of the Writing Studies department, and many of its tutors are recruited by Writing Studies professors, so naturally it follows that there is a

functioning relationship between the Writing Center and the Writing Studies department. The Engineering department, however, does not have the advantage of close administrative ties nor that of close physical proximity to the Writing Center. My interview with Craig, as well as my experience as an engineering student, suggests that the engineering faculty are not familiar with the services provided by the Writing Center, and my experience as a tutor suggests that their lack of familiarity has been passed on to engineering students, who appear equally uninformed about the Center's work. If familiarity is cultivated between the Engineering school and the Writing Center, the quality and frequency of sessions with engineering students are likely to improve.

Winsor suggests that most engineering writing is done not for purely practical reasons, but also for the constructing of the engineering identity by “[creating] rather than [describing] a logical world in which [engineers] themselves behave logically” (66). This is consistent with both Craig’s assertion and my own experience. Upon reflection, I found that my engineering writing fits Winsor’s description: its objective, impersonal language does more than attempt to remove ambiguity (as subjectivity does not necessarily correlate with ambiguity); the impersonal language is meant to construct the identity of a purely logical and unbiased investigator of universal phenomena. My own writing education seemed geared toward fostering a style and sense of android-like impartiality, so that our focus would be on the logical progression of ideas, and less on our interpretation of events. Though engineering work is “based at least partially on hunches, creative instinct, and tacit knowledge gained from

past experience,” Winsor asserts, “these factors have no place in engineering ideals” (66). Essentially, engineer writing is shaped to suggest that every decision is the result of careful and rational deliberation on expressible and quantifiable ideas.

Craig contributes to students’ conceptualizations of the engineering self through writing. Whereas many other class settings require thorough use of primary engineering tools (the natural laws and equations that govern engineering practice), Craig’s courses interject the use of writing as a means of explaining those laws and equations, and justifying decisions based on the intersection of design requirements and natural laws. These assignments help craft the engineering identity by forcing the engineering student to think critically about their decision-making processes and apply their previous knowledge to complete long-term projects.

In one such assignment, I was required to walk my audience through the process of designing a rotary inverted pendulum. Though this assignment was different from the typical engineering assignment in that the writing was its own final product, rather than something incidental to the project at hand, its purpose was the same as both Winsor and Craig describe—story telling. The equations for modeling the system and the coding for computer simulations had been given to us, so our purpose was not to design the system from scratch, but rather to make improvements to the system by designing a better controller (there were several types of general formats available) and explain our reasons for the design. Our explanation, of course, was “detail free,” as Craig describes; we only used general equations of motion and descriptions of key terms and variables in our writing. We were

required to use time response data (essentially a graph that shows a motor's speed or position over a period of time), but those graphs were selected because they contributed to the story—the responses from failed simulations weren't used, but successful ones were. The data and equations weren't the core of the project as some (including my classmates, at the time) may believe. The necessity of argument remained, and though the equations and simulation results were useful pieces of evidence, they didn't make the argument themselves.

I showed this assignment to a classmate in our writing center's pedagogy course (after my failed attempt with d'Alembert's paradox), and though initially she was off-put by the heaviness of the graphs and equations, she and I were able to talk about what the equations and visuals meant, and how they were able to demonstrate the success or failure of my controller design. The success of this conversation was largely due to her persistence in asking what my terms meant (which required that I explain the terms in less technical and more accessible terms), and also her persistence in asking why it was important that I used those equations and simulations. Frankly, that was the question that was inevitably most useful to me in my writing of that assignment, and was ironically the question I hadn't thought to ask.

This interaction, like many engineering sessions in the writing center, did not involve an engineering specialist tutor, and still it provided valuable feedback for my assignment. Perhaps without knowing it, my classmate, having assumed the mantle of tutor, had prompted my thinking about my purpose in writing, the way that my discourse community produces knowledge, and how I was able to meet the standards of my community through my use of evidence and logical justification for my decisions.

## Conclusion

Literature suggests that writing center sessions with engineering students shouldn't be as difficult as many tutors make them out to be; engineering students, like any other students, require help with organization, argument construction, and the appropriate use of evidence. Though the tutor's lack of content mastery may hinder their ability to understand some of the content of a client's work, this hindrance shouldn't be out of the ordinary. After all, many of the center's tutoring sessions already involve cross-disciplinary tutoring.

I believe that the first step of the solution may be simple: dialogue should be immediately established between writing centers and engineering schools. STEM faculty can also share their assignments with their writing center so that the writing center can better understand how engineering knowledge is produced and organized. This will address the misconceptions about the mission of writing centers, and will allow writing centers to familiarize themselves with the writing produced by engineering schools. Moreover, technical writing workshops, led by both writing center directors and STEM faculty, can be instituted at the writing center to help familiarize tutors with technical writing, not so that they will have the same technical expertise of the writer, but *so that they will be familiar with the identity of the engineer and their writing*. This exposure may also lessen the impact of science or math-induced anxiety for tutors in future sessions.

Familiarity with technical writing is a valuable tool, not just for writing tutors, but for anyone who intends to make sense of the technological and scientific progress of humanity. However, this familiarity, though useful, shouldn't be necessary for the engineering session. The same strategies

that are used in other sessions can be used in the engineering writing session: scaffolding, questioning, and brainstorming. There is real value to encouraging the engineering writer to think in the “sixth grade” terms Craig mentions, and to asking them how each component of their writing contributes to their assignment. “They resemble the rest of us,” Winsor writes, asserting that

the engineering writer is different only in that they “[show] greater resistance to knowing that language mediates experience” (68). The engineer’s identity, and therefore their writing, is no less socially constructed than that of any other writer. The writing tutor, regardless of their technical literacy, is therefore just as capable of tutoring an engineering student.

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### **Appendix: Interview Questions**

1. What are some of the defining features/characteristics of writing within your professional field?
2. What motivates your writing?
3. How important is the use of visual data in the presentation of your content?
4. Is collaboration common in your field?
5. Is collaboration recommended?
6. What are the advantages of writing within your field? What are the strengths of writing produced in your field?
7. What are the some of the weaknesses of the writing produced in your field?
8. What, as an instructor, do you look for in a written assignment from your students?
9. What are some of the general strengths students in your field demonstrate in their writing?
10. What are their weaknesses?
11. What do you think the writing center [at your institution] can do to help students improve their writing?

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