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Introduction

INTEGRATING WRITING THROUGHOUT ONE COLLEGE, MANY DEPARTMENTS

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This volume examines Writing in the Disciplines (WID) from a cultural theoretical perspective (Becher and Trowler 2001; Klein 2009), reporting on a collaboration between writing and engineering to develop a model undergraduate program in which writing was integrated throughout the curriculum. To date research has tended to either (1) emphasize the challenges students face when writing in their discipline or (2) emphasize the challenges WID instructors face when collaborating with those outside their discipline. We focus on the second, less-examined challenge, proposing that tension is a normal aspect of collaborating between disciplines. Specifically, the chapters in this volume address dissonant areas of cultural assumptions and dispositions between the "hard" and "soft" disciplines of engineering and writing and how they were negotiated or ameliorated.

In *Learning to Communicate in Science and Engineering: Case Studies from MIT*, Mya Poe, Neil Lerner, and Jennifer Craig (2010) identify and elaborate some of the challenges engineering students encounter as they learn to write for an audience of peer engineers. While the book focuses on student learning, the authors also claim that they, too, learned through their experience, though they provide little elaboration. "At times," they remark, the collaboration between writing and engineering was "frustrating, as our values and background knowledge seemed so disparate" (199). Likewise, Lea Anna Cardwell (2016), managing editor of the *WAC Journal*, similarly points out that WAC/WID work can be tenuous, as demonstrated when she wrote a call for papers for a volume on "concerns or problems" in writing across the curriculum (WAC). This collection speaks to both Poe's et al. and Cardwell's comments, illuminating how interdisciplinary collaboration is a coming together of different values and perspectives; the timely chapters in this volume examine

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some of the areas where particular misunderstandings occurred during collaboration between members of a College of Humanities and a College of Engineering at a large public research institution.

The volume represents the collective experiences and insights of writing consultants involved in a large-scale curriculum reform of an entire college of engineering; they collaborated closely with faculty members of the various departments and taught writing in engineering classrooms to engineering students. The unique project was initiated in 1996, when, in anticipation of an accreditation review, the chair of the Department of Mechanical Engineering contacted me to request help in improving his students' writing. After several meetings with him, I decided that since I was unfamiliar with the knowledge of the discipline and the specific culture of the department (see Godfrey and Parker 2010; Pawley 2009 for descriptions of engineering culture and beliefs), it would be best to move slowly. There would be no quick fixes; instead, I spent a year as an ethnographic observer attending undergraduate design sequence classes in the Department of Mechanical Engineering and taking notes as if I were an engineering student. Through immersing myself in the classroom talk and conversations, I came to have a better, yet imperfect, understanding of how writing could be incorporated into a department-wide curriculum, not as an "add-on," but as an integral component of courses. After one year, I had a sense of where writing might be most useful in the design curriculum and at what points for specific learning goals. Six courses were selected, from the introductory first-year design course through the capstone.

The goal was to simulate—as much as is possible—the demands of workplace writing in these courses (see Dannels 2000). Employing a situated learning model, writing became part of the practice of engineering for students. Whereas before they had writing assignments scattered throughout the curriculum, the new curriculum implemented writing at strategic engineering teaching moments, starting with easier genres and graduating to more difficult ones, spiraling throughout the curriculum. With this scaffolding, zones of proximal development were created to support students as they progressed through the curriculum and increased their knowledge of practices (Vygotsky 1978); writing assignments in one course prepared them to undertake more difficult writing assignments in future courses. For example, in an early design course, students learned to write memos to their "manager" as a means of keeping him or her informed about their progress on a project. A course taught after the design course still included memos but added a feasibility report in which students responded to a request for proposals

(RFP) to build, say, a grease trap. Writing assignments and engineering content were concomitant, and as students progressed through the curriculum, both became more complex, while reinforcing previously learned genres. Earlier work set the stage for later work so that students could learn new genres as they encountered new contexts of practice while strengthening previously learned genres. Genres are powerful instructional tools; as Marie Paretti (2008) notes, "analyses of genres in academic, government, and industry sites have provided compelling insights into the ways in which the structure, tone, content, organization, and related features of documents support the human activities to which those documents respond" (493). Having students write throughout their course work supported their becoming more prepared for activities in the workplace.

My own observations and suggestions were mediated through regular meetings with engineering faculty in the department, who in collaboration with me created the curriculum for the design sequence in mechanical engineering so that students would strategically learn about and practice specific genres of engineering communication that were relevant to their professional identities. Over the course of two years, I collaborated closely with the mechanical engineering professors whose courses were included in the new curriculum. We developed syllabi that incorporated writing into their courses in meaningful ways, designed lessons to teach various aspects of writing, created assignments that integrated engineering and writing theory and concepts, and worked one on one with students to provide feedback for revision. In the first year of implementation, I was the sole writing consultant embedded within engineering. I attended classes and provided minilessons about the type of writing students were being asked to complete and how it was relevant to the workplace. Minilessons were critical, as the engineering professor who was in the classroom could elaborate on engineering practices and provide stories about workplace life and the positioning of writing within it. I also attended labs and met with student teams to support their learning of the relevant genres and to provide feedback. The initial year was intensive, with me spending approximately six to eight hours weekly in mechanical engineering while maintaining my normal load in my own department.

As the relationship between writing, communication (there was also an oral component of the program), and engineering developed, we scrambled to fund graduate students who had a keen interest in the technological sciences and writing and who wanted to fulfill their graduate teaching assistantship full-time in the department. For many years

we drew from whatever resources on campus we could to fund graduate writing consultants.

With ABET 2000, or EC 2000 as it is also known, the imperative for a wider program integrating communication across the college of engineering curriculum became more pronounced. The newer outcome criteria for undergraduate engineering education called for students to demonstrate "the ability to communicate effectively." These criteria, explains Carolyn Miller (2004), were not ranked in terms of importance, highlighting the potential synergies among them. Furthermore, "the criteria emphasized that communication is a strategic, situated enterprise that must be judged in context and with an understanding of the constraints and conventions in play and of the challenges to be met" (42). The goals of the program we had begun years before aligned with the new criteria and were highly valued in the workplace.

In light of EC2000, and with a successful curriculum in place in mechanical engineering, we became one of nine engineering colleges under the Engineering Schools of the West Initiative (ESWI). As part of this group, in 2003, we were awarded a $1.1 million William and Flora Hewlett Foundation Grant over five years that allowed us to expand and solidify the established program in mechanical engineering to house a "Center" across four additional departments: bio; chemical; civil and environmental; and materials science. In addition to writing, oral communication and ethics were also part of the engineering curriculum. Other institutions in ESWI received varied funding for projects that ranged from hosting summer camps for middle and high school students, to working with science teachers (for a description of the larger project, see Plumb and Reis 2007).

Our program was unique because the teaching and learning of writing and oral communication occurred *in* engineering classrooms and not as separate courses. Our program was similar to a writing fellow program but differed in significant ways. In their introduction to a special volume in *Across the Disciplines*, Brad Hughes and Emily Hall (2008) explain that while such programs vary in their implementation of goals, they commonly "link students to specific writing-intensive courses, they encourage partnerships between a [w]riting [f]ellow and a course professor; and they promote collaboration between peers" (1). The origin of fellow programs traces back to Tori Haring–Smith, who after first establishing a drop-in writing center developed the first writing fellow program in the country in 1982 at Brown University. According to Haring-Smith (1992), the goal of the program was to provide support to undergraduate students for courses across the curriculum. Using undergraduate students

trained to provide peer support, fellows worked with faculty who represented a range of academic disciplines to better understand their assignments, particularly their purpose and expectations for performance. The information garnered from these meetings helped fellows provide more targeted feedback to students on their drafts and in conferences. Haring-Smith made it clear that writing fellow programs differ from writing centers in that rather than students coming to one central location, fellows go into classrooms and work with faculty and their students. Throughout the duration of a term, faculty and fellows communicate to apprise each other of key information or needs to sustain relationships and enhance writing quality. Other institutions have since established their own writing fellow programs, adapting them to their unique educational contexts with common outcomes (McLeod and Soven 2000; Mullen 2008; Thaiss and Zawacki 2006), including deeper appreciation of, and increased attention to, writing from faculty across the disciplines and improving faculty-writing relationships. Of great importance, research shows that writing fellow programs can have a positive impact, improving the quality of student writing (Rossman-Regaignon and Bromley 2011), including that of nonnative speakers of English (Manley 2014).

Our program distinguished itself from writing fellow programs because it (1) was intended to reform the curriculum of a college and not just one course; (2) was focused on one field of study, engineering, incorporating its subdisciplines; (3) was established using a situated learning perspective, where students learn best in the situations for which the information and practices are relevant; (4) assigned graduate student consultants to an entire department, rather than undergraduate peer fellows to a single course; (5) assigned graduate students to the same department and courses over two or more years; and (6) housed the consultants in the College of Engineering; their offices were located in the building that housed other engineering faculty. They were also paid through engineering. This configuration of characteristics made them "Sojourners," travelers to a new disciplinary culture (explained in more depth in chapter 1). Conceptually the program shared many of the same attributes of a writing fellow program, but had more in common with the one at CUNY that Mary Soliday (2011) describes in *Everyday Genres: Writing Assignments across the Disciplines*. Like Soliday, our guiding theory was that of situated cognition, viewing engineering students at our institution as apprentices; and our focus was also on the teaching and learning of genres. CUNY embedded graduate students in classrooms to teach and collaborate alongside professors, as did we. Both programs facilitated change in assignments and the support of

students in fulfilling them successfully through conferencing. The programs also had marked differences.

Whereas the graduate fellows at CUNY represented various fields (e.g., education, music), our graduate students were either advanced MA or PhD students in rhetoric and writing studies and had a level of expertise in writing theory and practice. Unlike CUNY, where graduate fellows were selected to work with one faculty member, our goal was to impact an entire academic college rather than a single course or faculty member. To do this meant collaborating with faculty across the College of Engineering to establish a novel, reciprocal model whereby graduate consultants in writing learned about engineering as faculty in engineering learned about writing. The two expertises were exploited to develop new territory. That is, our fellows, called "consultants" because of the expertise they brought to the project, did not go in and solely work in one class with extant assignments to improve them, or create new assignments as Soliday's did, but collaborated with multiple faculty and their courses in one entire department to develop curricula, teach, and support writing at strategic learning moments for students. In many cases, writing was integrated into key courses that did not previously include it to create a coherent and more seamless curriculum.

It should be noted that every department was treated as its own unique culture given its purpose, history, and practices are distinct from each other. Assignments developed for mechanical engineers would not likely transfer to bioengineers, who operate with different scientific theories, applications, and goals. Audiences vary across engineering subdisciplines, as do their rhetorical means of persuasion. They have their own professional associations (American Institute of Chemical Engineers vs. American Association for Engineers), journals (*Journal of Material Science* vs. *Biotechnology and Bioengineering*); conferences (American Society of Mechanical Engineers Conference vs. Electrical Transmission and Substation Structures Conference). and use of specialized language and visuals. In effect, each subdiscipline of engineering represents a separate discourse community (see Swales 1990). This can become complicated because subdisciplines are even more fine-grained when considering specialties. This is made clear in Thaiss and Zawacki's (2006) book *Engaged Writing, Dynamic Disciplines: Research on the Academic Writing Life*, when they interview professors about their areas of expertise: "Regan, although naming her discipline 'political science,' said she could identify 40 distinct branches of the field, each with its own journals and standards, and saw her own work as 'technology studies,' distinct, say, from 'policy studies'" (34).

The authors in this volume were some of the very first writing graduate students to be placed into the different departments of engineering; they worked closely with faculty to design a curriculum that rang true to the principles of writing and rhetoric and to the specific cultures of the departments of engineering into which they were placed. No one had the same experience, though some had similar frustrations. They were "on the ground," so to speak, at the inception of the college-wide program. Being present at the beginning allowed them to experience firsthand the tensions that arose during the implementation of organizational change (Faber 2002). More often than not, contrasting beliefs about writing and its role in engineering came to the forefront when collaborating. What were the beliefs? How were they engaged? How were they negotiated?

While programs that integrate writing into engineering curricula are unique, the experience of entering a new academic culture so different from one's own is not. Accounts of tensions and incongruities across disciplines abound in the literature. With the exception of Chris Anson (2002), however, few are based in on-the-ground experience. His casebook is helpful in creating awareness of the tensions and posing questions about how to respond in such situations. The current volume, like Anson's, acknowledges that tensions arise. They are a fact of interdisciplinary collaborations. While they may be uncomfortable to engage, they are healthy in that they signal a pathway to improve collaboration and its goals. Tensions indicate differences in epistemologies and ideologies and their constitutive practices. They serve as references to different histories and trajectories of disciplines. And they provide critical points for understanding.

In their study about successful collaborations across disciplines, Maura Borrego, Lynita Newswander, and Lisa McNair (2007) comment that the ability to be open to and appreciate different views about knowledge is important, especially when the disciplines collaborating hold very different beliefs about it. But it may take time for the appreciation to develop. When instructors of writing collaborate across disciplines, unequivocally they will, as Michelle Fine says, hit "speed bumps," at least in the early stages of collaboration. Speed bumps, she explains are "raised places in the road that limit one's speed. When we are moving too fast, we must suddenly slow down or be thrown off course" (1). And so it was with the writing consultants, sojourners traveling to another discipline, confident in their own cultural beliefs and values, but unfamiliar with those in engineering. Change was slow in integrating writing and engineering; moving too quickly would have thrown us off course (and still, moving slowly, we sometimes were).

This volume is relevant for those interested in pursuing WAC/WID (potentially CID), either as newcomers or in the early stages of collaboration, and for those interested in implementing an extensive program like ours. The book addresses interdisciplinary teaching from various perspectives, with each chapter taking up an issue related to collaborating between disparate disciplines. Through a variety of styles and methods, the volume relays the first years of the program. The first two chapters furnish the background for the project. Chapter 1, "Sojourners and Third Cultures: Raising Cultural Awareness in Interdisciplinary Programs," maps out the theoretical foundation of the volume and project. Employing intercultural communication theory, Maureen A. Mathison and Mara K. Berkland theoretically examine disciplines as cultures and address five issues that can impede successful interdisciplinary collaboration. Chapter 2, "Professors Designing Assignments as Relational Activity: A Baseline for Connecting Thinking, Learning, and Writing," applies an activity theory perspective, illuminating how writing was initially situated in the College of Engineering before the collaborative project commenced. Through interviews with professors and analysis of their course materials, Maureen A. Mathison and Linn K. Bekins found distinct approaches to activities in their classrooms, with some more aligned with writing theories and practices than others. The interviews also provided a rough baseline in anticipation of the ways writing was being addressed in distinct departments when consultants entered into their classrooms.

The next three chapters examine how graduate student writing consultants engaged engineering faculty as curricula were revised. This was a major endeavor, particularly at the beginning of our relationship, when our differences became visibly and viscerally apparent. The chapters, in the words of Melinda Whitfield (2014), are told "through the voices of the story-telling authors," a rich narrative style (239) that recounts their "real-life experiences" (238). This is apparent as each author narrates his or her experience. The chapters comprise different richly textured voices, each author accounting for their distinctive collaborative style. They write of concerns relative to their position, and employ varied theoretical lenses and methodologies for their analyses. Combined they provide insight into the multilayered complexity of collaboration between WAC/WID programs and their academic partners. In chapter 3, "Teaching (Each Other) (about) Writing," Doug Downs focuses on how cultural conceptions of writing between those in writing (rhetoric) and civil and environmental engineering (scribal) differ and how those conceptions served as the basis for teaching each other

about disciplinary assumptions. Sarah Read and Maureen A. Mathison, in "Locating Common Ground for Diplomacy: Using Critical Thinking to Teach Writing" (chapter 4), recount the role of establishing diplomacy as a writing consultant, and the Chemical Engineering faculty collaboratively designed a curriculum that ultimately became a guiding document for writing throughout the department. The next chapter, "Moving Toward Successful Interdisciplinary Integration in Team-Taught Courses: Building Cultural Bridges through Assignments" (chapter 5), by Mara K. Berkland, demonstrates how the theoretical and pedagogical interests of those in writing and mechanical engineering came together to create assignments that resonate for both engineers and writing consultants. These chapters demonstrate, to differing degrees, the levels of miscommunication experienced as cultures collided, and as collaborators stretched to understand the other.

The next series of chapters are research based, drawing on qualitative and descriptive methods. Chapters 6 and 7 address a key hallmark of engineering practice: visual approaches to conceptual understanding. Through their training, writing instructors have been more immersed in the verbal aspects of teaching and learning (though this is rapidly changing), whereas engineering often relies on the visual. To connect the verbal and the visual, writing instructors used the visual as a starting point. How do engineers view the role of visuals in writing, and how do students integrate them into their engineering work? In chapter 6, "'I Don't Have to Argue My Design—The Visual Speaks for Itself": A Case Study of Mediated Activity in an Introductory Mechanical Engineering Course," Maureen A. Mathison, through analysis of teacher talk and classroom discussions, and student surveys, reports on a qualitative study in which conceptions of writing, initially thought to be congruent, were widely disparate, highlighting the different communication needs of respective disciplines. Sarah A. Bell in chapter 7, "I See What You Mean: Mechanical Engineering Students' Use of Visuals in a Research Paper Assignment," uses the visual as a basis for understanding connections between the visual and the verbal. Her analysis of students' research reports helps her better understand how to integrate the purpose and use of visuals into her teaching.

The last two chapters examine difference as both a barrier and a solution. Chapter 8 highlights the differences between the "hard" and "soft" disciplines as manifested in gender. Awareness of the importance of gender, race, and ethnicity in the core and technical sciences has increased in recent years. Organizations such as the American Association for the Advancement of Science (AAAS) and the National Science Foundation

(NSF) have made a point of emphasizing inclusivity because of the paucity of broader representation across fields. In the chapter "Ideologies of Gender: Culture Clash between the Disciplines," authors April A. Kedrowicz and Julie L. Taylor analyze student feedback in two departments, mechanical and civil and electrical engineering, to determine how student engineers value practices they perceive as "masculine" and devalue the work of the "feminine" writing consultants. In their research, Kedrowicz and Taylor uncover problematic power attitudes about females teaching in male-dominated contexts. In chapter 9 Sundy Watanabe offers a solution to the tensions that arise as interdisciplinary partners grapple with theories, practices, dispositions, and identities. Her chapter, "Intercultural Collaboration: Respect, Relationship, Responsibility, and Reciprocity," offers a novel approach for those thinking about engaging in interdisciplinary work. Employing an Indigenous framework, she examines how difference can be used productively to respect ways of being without the responsibility falling on one group or the other. Finally, Maureen A. Mathison concludes the volume with her chapter "Sojourning, Resistance, and Trust." In this chapter Mathison synthesizes the experiences of the consultants as told through their chapters, and analyzes interviews with participating engineering faculty members with whom the consultants' collaborated to discern areas of success and areas that posed challenges for both groups. In closing she discusses the role of trust—cognitive, affective, and cultural—in establishing more fluid relationships across disciplines.

Programs that integrate writing and speaking into the curriculum have demonstrated measures of success (e.g., Poe, Lerner, and Craig 2010). Data from our own program demonstrate that students' writing improved. To determine if our curricula were supporting student learning, we compared student capstone papers from before we began the collaboration with those of students who had gone through all four years of our interdisciplinary program. On a number of measures students who had completed all the courses in which writing was integrated into engineering statistically wrote better than those who had not (Mathison et al., unpublished). Although our interactions were sometimes rife with tensions, the two groups—writing and engineering—developed a "third culture" that generally placed students at the center of learning.